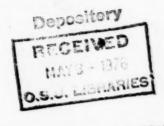
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# **SESOURCES**RESOURCES ABSTRACTS



VOLUME 9, NUMBER 8 APRIL 15, 1976 SELECTED WATER RESOURCES ABSTRACTS is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce, for the Water Resources Scientific Information Center (WRSIC).

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# SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior



VOLUME 9, NUMBER 8 APRIL 15, 1976

W76-03501 - W76-04000

The Secretary of the U.S. Department of the Interior has delemined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978. SELECTED WATER RESOURCES

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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#### **FOREWORD**

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the Water Resources Thesaurus. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center Office of Water Research and Technology U.S. Department of the Interior Washington, DC 20240

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**ABSTRACT SOURCES** 

#### SELECTED WATER RESOURCES ABSTRACTS

#### 2. WATER CYCLE

#### 2A. General

INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES.

National Oceanic and Atmospheric Administration, Rockville, Md. For primary bibliographic entry see Field 2H. W76-03725

INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES.

National Oceanic and Atmospheric Administration, Rockville, Md. For primary bibliographic entry see Field 2H. W76-03726

ON THE GENERATION OF MESOSCALE ED-ON THE GENERATION OF MESOSCALE ED-DIES AND THEIR CONTRIBUTION TO THE OCEANIC GENERAL CIRCULATION. I. A PRELIMINARY NUMERICAL EXPERIMENT, National Oceanic and Atmospheric Administra-tion, Princeton, N.J. Geophysical Fluid Dynamics Lab. Lab

For primary bibliographic entry see Field 2L. W76-03734

ON THE GENERATION OF MESOSCALE ED-DIES AND THEIR CONTRIBUTION TO THE OCEANIC GENERAL CIRCULATION. II. A

PARAMETER STUDY,
National Oceanic and Atmospheric Administration, Princeton, N.J. Geophysical Fluid Dynamics

For primary bibliographic entry see Field 2L. W76-03735

RELATIONSHIPS BETWEEN PRECIPITATION, STREAM WATER CHEMISTRY, AND VEGETATION FOR THE BOWL, A FORESTED WATERSHED IN NEW HAMPSHIRE,

New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources. For primary bibliographic entry see Field 4D. W76-03875

A LATE HOLOCENE POLLEN RECORD FROM PEARSON'S POND, WEEKS CREEK LAND-SLIDE, SAN FRANCISCO PENINSULA, CALIFORNIA,

Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 2I. W76-03896

A LATE HOLOCENE POLLEN DIAGRAM FROM NEAR LAKE TAHOE, EL DORADO COUNTY, CALIFORNIA, Slovenska Akademija Znanosti in Umetnosti, Ljublijana (Yugoslavia); and Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 21. W76-03897

RAINFALL-RUNOFF RELATION REDWOOD CREEK ABOVE ORICK, CALIFOR-NIA,

Geological Survey, Menlo Park, Calif. K. W. Lee, G. W. Kapple, and D. R. Dawdy Open-file report, November 1975. 14 p, 1 fig, 4 tab, 4 ref.

Descriptors: \*Rainfall-runoff relationships, \*Model studies, \*Lumbering, \*California, Baseline studies, Vegetation effects, Clearcutting, Environmental effects, Runoff, Storms, Computer models. Identifiers: \*Redwood Creek(Calif).

A digital computer was used to calibrate a model for synthesizing daily runoff for two periods, one in the late 1950's before intensive logging began and another in the late 1960's and early 1970's after intensive logging had been started, in the Redwood Creek basin on the northern California coast. The calibrated models were used with the daily rainfall records for these two periods to provide estimates of synthetic daily runoff records. The storm season runoff is about 20 percent greater than would be expected for the period before the beginning of intensive logging. (Woodard-W76-03903

HYDROLOGIC RELATIONS UNDISTURBED AND CONVERTED BIG SAGEBRUSH LANDS: THE STATUS OF OUR KNOWLEDGE,
Forest Service (USDA), Laramie, Wyo. Forest

Range and Watershed Lab. D. L. Sturges.

USDA Forest Service Research Paper RM-140, March 1975. 23 p, 18 fig, 4 tab, 41 ref.

Descriptors: \*Sagebrush, \*Watershed management, \*Range management, \*Water yield, \*Sediment discharge, Surface runoff. \*Streamflow, \*Snow management, Snowdrifts, Plant-water-soil relationships, Vegetation effects, Water yield improvement, Suspended load, Snow-melt, Hydrographs. Identifiers: \*Big sagebrush, \*Oversnow flow.

The purpose of the paper is to guide hydrologists and land managers by providing information on (1) what is known about the hydrology of big sagebrush lands, and (2) how this knowledge can be effectively used in reaching management deci-Three subspecies comprise the sagebrush complex and each is indicative of important environmental factors. Big sagebrush lands receive about 8 to 20 inches of precipitation annually and one-half to two-thirds of the total falls as snow. Lands in higher precipitation regions of the type are the source of perennial streamflow. The climate, vegetation, snow accumulation, and water yield characteristics for big sagebrush lands are described. The influence of land management practices on vegetative composition and the hydrologic regime is outlined in detail. Potential hydrologic benefits from managing blowing snow in the big sagebrush zone is highlighted as well as additional research needs. (Forest Service) W76-03967

#### 2B. Precipitation

SOLAR HEATING TO PREVENT FREEZING IN

RECORDING RAINGAUGES, Lincoln Coll. (New Zealand). Tussock Grasslands and Mountain Lands Inst. R. P. Stratford, and E. J. Costello. Journal of Hydrology (New Zealand), Vol 13, No 2, p 139-141, 1974. 2 fig.

Descriptors: \*Rain gages, \*Solar radiation, \*Freezing, Altitude, Meteorology, Heating. Identifiers: \*New Zealand.

A method was described to heat and prevent freezing of meteorological instruments at high altitudes in New Zealand. The specific instrument for which the proposed heating arrangement was utilized was the Lambrecht Automatic Siphoning raingage. The mechanism consisted of solar heating panels with necessary network of pipes. The design features of the heating arrangements were described with supporting figures. (Bhowmik-ISWS) LATE HOLOCENE POLLEN DIAGRAM

A LATE HOLLOCENE POLLEN DIAGRAM
FROM NEAR LAKE TAHOE, EL DORADO
COUNTY, CALIFORNIA,
Slovenska Akademija Znanosti in Umetnosti,
Ljublijana (Yugoslavia); and Geological Survey,
Menlo Park, Calif. For primary bibliographic entry see Field 2I. W76-03897

#### 2C. Snow, Ice, and Frost

SNOWMELT RUNOFF EFFICIENCIES ON ARIZONA WATERSHEDS. Forest Service (USDA), Silver City, N. Mex. Gila National Forest. For primary bibliographic entry see Field 3B. W76-03581

CONTRIBUTIONS TO THE CHEMISTRY OF ANTARCTIC SNOW: DETERMINATION OF TRACE ELEMENTS AT THE PPB LEVEL BY

ATOMIC ABSORPTION SPECTROMETRY, Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire de Glaciologie. C. Boutron.

C. Boutron.

Available from the National Technical Information Service, Springfield, Va 22161 as ADA 007 112, Price \$5.00 in paper copy, \$2.25 in microfiche. United States Army CRREL Draft Translation 424, January 1975. 80 p, 5 fig, 5 tab, 54 ref. Translated from Glaciology Laboratory, National Council for Scientific Research, Publication No. 138, May 10, 1971.

Descriptors: \*Snow, \*Polar regions, \*Chemical analysis, \*Trace elements, \*Analytical techniques, \*Antarctic, Meteorology, Precipitation(Atmospheric), Snow cover, Analysis, Snow non(Atmospheric), Snow cover, Analysis, Snow surveys, Neutron activation analysis, Instrumen-tation, Spectroscopy, Water chemistry, Sampling, Chlorine, Geochemistry. Identifiers: \*Snow impurities, \*Snow chemistry, \*Trace minerals, Polar snow, Atomic absorption

spectrometry, Sample preparation, Fallout table, Analytical problem.

The composition of the impurities contained in Antarctic snow has yet to be established. The published values have undergone repeated major revisions, and the concentration levels for a good many elements have yet to be determined. This work was based primarily on the study of geographical variations and on the establishment of a fallout table, backed up by some observations as to the identification of the various possible origins. Analysis by atomic absorption spectrometry of the elements sodium, magnesium, calcium, potassi-um, and iron was performed as well as analysis by neutron activation of the elements chlorine, sodi um, and manganese. The element most abundant in Antarctic snows is chlorine, found in concentrations on the order of 10 to the minus 7th power g/g of snow; most of the other elements are found in proportions below 10 to the minus 9th power g/g snow. Measuring such small concentrations presents special problems concerning sampling procedures on the ground and sample preparation, as well as with analytical techniques. (See also W76-03729) (Henley-ISWS) W76-03728

CONTRIBUTION TO THE CHEMISTRY OF AN-TARCTIC SNOW: TRACE ELEMENT DOSAGE BY NEUTRON ACTIVATION, Centre National de la Recherche Scientifique,

Grenoble (France). Laboratoire de Glaciologie. M. Echevin.

Available from the National Technical Informa Available from the National Technical Informa-tion Service, Springfield, Va 22161 as ADA 007 106, Price \$5.00 in paper copy, \$2.25 in microfiche. United States Army CRREL Draft Translation 423, November 1974, 80 p, 6 fig, 6 tab, 42 ref, 1 ap-pend. Translated from Glaciology Laboratory, Na-

#### Field 2-WATER CYCLE

#### Group 2C-Snow, Ice, and Frost

tional Council for Scientific Research, Publication No. 139, May 10, 1971.

Descriptors: \*Snow, \*Polar regions, \*Chemical analysis, \*Trace elements, \*Analytical techniques, Meteorology, Precipitation(Atmospheric), Snow cover, Analysis, Snow surveys. Neutron activation analysis. Instrumentation, Spectroscopy, Water chemistry, Sampling,

Chlorine, Geochemistry.
Identifiers: \*Snow impurities, \*Trace minerals,
Polar snow, Atomic absorption spectrometry, Sample preparation, Snow composition, Chlorinitv

A program of studies on impurities found in the polar snows, centering primarily on the Antarctic, was described. The program was conducted along two avenues: (1) spectrometric analysis of the atomic absorption of the elements, sodium, magnesium, calcium, potassium, manganese, and iron; and (2) neutron actuation analysis of the elements. chlorine, sodium, and manganese. In order to obtain the largest possible quantity of data, these two studies were run in very close collaboration and both bear on the analysis of the same samples. The most abundant element in the Antarctic snows was chlorine, present in concentrations on the order of 10 to the minus 9th power g/g of snow; most of the other elements were found in concentrations below 0.010 g/g of snow. (See also W76-03728) W76-03729

APPLICATIONS OF ERTS IMAGERY TO SNOW AND GLACIER HYDROLOGY,

Geological Survey, Tacoma, Wash M. F. Meier.

Reprint from Proceedings of Symposium on Approaches to Earth Survey Problems through Use of Space Techniques, held in Constance, Germany, May 23-25, 1973: Committee on Space Research (of the International Council of Scientific Unions) COSPAR, p 329-334, 1974. 6 figs.

Descriptors: \*Hydrology, \*Snow cover, \*Glaciers, \*Remote sensing, \*Satellites(Artificial), River basins, Washington, Snow, Water equivalent, Aerial photography, Hydrologic data, Meteorological data.
Identifiers: \*ERTS imagery, \*Thunder Creek basin(Wash).

The percentage of snowcovered area on specific drainage basins was measured from ERTS imagery by video density slicing using the Stanford Research Institute Electronic Satellite Image Analysis Console (ESIAC). Results were repeata-ble to 4% of the snow-covered area. Data from ERTS images of the melt season snowcover in the Thunder Creek drainage basin in the North Cascades, Washington were combined with existing hydrological and meteorological observations to enable calculation of the time distribution of the water stored in this mountain snowpack. Similar data could be used for frequent updating of expected inflow to reservoirs. Equivalent snowline altitudes were determined from area measurements. Variations in snowline altitudes were determined by combining enlarged ERTS images with maps; an accuracy of about 60 miles was attained under favorable conditions. ERTS imagery was also used to measure glacier accumulation area ratios, detect subtle flow structures on glaciers, identify surging glaciers and monitor changes in tidal glacier termini. (Woodard-USGS) W76-03902

#### 2D. Evaporation and Transpiration

CONTROLLING EVAPORATION OF WATER. Nalco Chemical Co., Chicago, Ill. (Assignee). For primary bibliographic entry see Field 3B. W76-03506

A SIMPLER EMPIRICAL EXPRESSION FOR ACTUAL EVAPOTRANSPIRATION RATES: A DISCUSSION,
Macquarie Univ., North Ryde (Australia). School

of Earth Sciences. E. T. Linacre

Agric Meteorol. Vol 11, No 3, p 451-452, 1973,

Descriptors: \*Evapotranspiration Evaporation

Data obtained in various conditions were collated to yield the following empirical relationship: EA = 0.732 - 0.050 (PE) + (4.97 (PE) - 0.661 (PE)2)MR - (8.57 (PE) - 1.56 (PE)2)MR2 + (4.35 (PE) - 0.880 (PE)2)MR3 mm/day where Ea is the actual measured evaporation rate of soil containing a fraction MR of the available water capacity, in conditions where the potential evaporation rate (of a fully wet surface) is PE mm/day. The actual evaporation rate equals whichever is the less of: the potential evaporation rate; or 16 (MR)2 mm/day, where MR is the proportion present of the available water capacity of the soil. This may be sufficiently accurate for irrigation agriculture, for instance.—Copyright 1974, Biological Abstracts, Inc.
W76-03521

FIELD STUDY OF EVAPOR CATALOGUE OF DATA FOR PHASE I, EVAPORATION-

Bureau of Meteorology, Melbourne (Australia).

Dept. of Science.
R. D. Hoy, and S. K. Stephens.
Australian Water Resources Council Technical Paper No. 11, 1975. 51 p, 5 fig, 13 tab, 6 ref, 2 ap-

Descriptors: \*Evaporation, \*Australia, \*Data collections, \*Data storage and retrieval, Rain, Water resources, "Data storage and retrieval, kain, water resources, Temperature, Meteorological data, Winds, Humidity, Lakes, Water shortage, Inflow, Water storage, Instrumentation, Measurement, On-site data collections, Information retrieval. Identifiers: "Measuring evaporation, "Lake Mundaring(Australia), "Lake Manton(Australia), daring(Australia), \*Lake Manton(Australia), \*Lake Cateract(Australia), \*Lake Eucumbene(Australia).

The paper described meteorological and hydrological data collected and the data archive for the four lakes in Phase 1 of the Australian Water Resources lakes in Phase I of the Australian Water Resources Council Research Project 68/5--Field Study of Evaporation. Three lakes were selected for the data collection project: Mundaring near Perth, Manton near Darwin, and Cateract near Sydney. After commencement of the study, it was decided to include similar data collected during 1962-1964 by the Snowy Mountains Hydro-electric Authority from Lake Eucumbene in New South Wales for schiving computation and analysis. Petals on archiving, computation, and analysis. Details on the availability and reliability of the data, and on computer procedures used by the Bureau of Meteorology in Melbourne to edit and archive the data from the four lakes, were given. An indication of the vast quantity of continuous and reliable data in the archive was given, and information was provided for scientists and engineers on the procedure to retrieve data. Two other volumes have been published on the study, as Technical Papers Nos. 1 and 2 in the same series. These described the installation, operation and maintenance of equip ment, and the extraction and computation of the data. (Roberts-ISWS) W76-03724

#### 2E. Streamflow and Runoff

FLOOD HAZARDS ALONG THE BALCONES ESCARPMENT IN CENTRAL TEXAS-ALTER-NATIVE APPROACHES TO THEIR RECOGNI-TION, MAPPING, AND MANAGEMENT, Texas Univ. at Austin. Dept. of Geological Sciences.

For primary bibliographic entry see Field 4A.

OCEANIC VELOCITY GRADIENTS

Texas A and M Univ., College Station. Dept. of Oceanography. For primary bibliographic entry see Field 2L. W76-03736

OUTPUT FROM A CASCADE OF DISCRETE LINEAR RESERVOIRS WITH STOCHASTIC

INPUT, Department of Environment, Ottawa (Ontario).

V. Klemes, and L. Boruvka.

Journal of Hydrology, Vol 27, No 1/2, p 1-13, October 1975. 4 ref, append.

Descriptors: \*Reservoirs, \*Stochastic processes, methods, \*Mathematical street, analysis, \*Systems analysis, \*Drobability, \*Mathematics, \*Statistical \*Mathematical Analytical techniques, Storage, Flow, Probability, Discharge(Water), Inflow.

Identifiers: \*Linear reservoirs, \*Marginal distribu-tions, \*Autoregressive input, Probability density function, Cascade output.

A mathematical description was given of the output resulting from a stochastic input to a cascade of linear reservoirs. The input process was considered an auto regressive type with a continuous marginal probability density function. First, the stochastic structure of a cascade output from a random input was investigated. The dependence of output from a reservoir on outputs from all the upstream reservoirs was transformed into a dependence on the past outputs from the reservoir under conderation. For identical upstream reservoirs, the expression for this dependence became quite simple. The expression was generalized for some reservoirs being dissimilar. Finally, the probability density function of output from a cascade of linear reservoirs fed by an upstream autoregressive input of a given order was derived. (Singh-ISWS) W76-03742

MEASURING WATER VELOCITY BY ULTRASONIC FLOWMETER,
Bureau of Reclamation, Denver, Colo. Hydraulics

For primary bibliographic entry see Field 8B. W76-03749

THE RIVER THAMES FLOOD DEFENCE BAR-

RIER, Great London Council, (England), Dept. of Public Health Engineering. For primary bibliographic entry see Field 4A. W76-03800

STREAM CHANNEL MEASUREMENTS IN NEW ZEALAND, Victoria Univ., Wellington (New Zealand). Dept.

of Geography.

For primary bibliographic entry see Field 7A.

W76-03856

APPENDIX 2, SURFACE WATER HYDROLOGY, GREAT LAKES BASIN FRAMEWORK

GY, GREAT STUDY.
Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office.
1975. 133 p, 94 fig, 9 tab, 75 ref.

Descriptors: \*Great Lakes Region, \*Hydrologic data, \*Surface waters, \*Great Lakes, \*Surface water availability, \*Surface runoff, Runoff, Streamflow, Floods, Flood data, Flood frequency, Flow duration, Frequency analysis, Discharge(Water), Discharge frequency, Data collections, Hydrology, Low flow, Low-flow frequency, Droughts, Reservoir sites, Regional analysis, Water supply.

This appendix provides a generalized evaluation of surface water runoff entering the five Great Lakes

#### Groundwater-Group 2F

from tributary streams in the United States. Of the 298,000 sq mi in the Great Lakes Basin, 115,000 sq mi are in the United States and 88,000 sq mi lie in Canada. No new basic data were gathered for this appendix. Surface water data presented included runoff analysis, flood characteristics, drought flows, surface water availability and reservoir sites. Average monthly runoff as well as maximum and minimum monthly runoff values were presented for 143 stations. Maximum flow and stage as well as 2, 50 and 100 year discharges were presented for 187 stations. Generalized peak frequency curves were also presented. For 154 sites instantaneous, 1-day and 7-day recorded low flows as well as expected 1-day, 30 year, and 7-day, 10 year low flows were presented for 15 subareas, and 672 reservoir sites with surface areas greater than 500 acres were documented. (Terstriep-1SWS)

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APPENDIX 11, LEVELS AND FLOWS, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 4A. W76-0386.

APPENDIX 14, FLOOD PLAINS, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 4A. W76-03867

REGIONAL SKEW IN SEARCH OF A PARENT, Geological Survey, Reston, Va. N.C. Matalas, J. R. Slack, and J. R. Wallis. Water Resources Research, Vol 11, No 6, p 815-826, December 1975. 10 fig. 11 tab, 7 ref.

Descriptors: \*Flood frequency, \*Forecasting, \*Regional analysis, \*United States, \*Regression analysis, Correlation analysis, Methodology, Analytical techniques, Historic floods, Evaluation.

Identifiers: \*Coefficient of skewness, Historical flood sequence, Mean-standard deviation relationship.

A problem of continuing interest in flood frequency analysis is that of obtaining a reliable estimate of the coefficient of skewness for a historical flood sequence. To compare historical estimates of the coefficient of skewness with those derived from Monte Carlo experiments, historical flood records at 1351 stream-gaging stations were used. The historical records, a sample from the nearly 10,000 stream-gaging stations in the United States, were considered to be of good quality, the effects of regulation and diversion being minimal. The relationship between the mean and the standard deviation of regional estimates of skewness for historical flood sequences is not compatible with the relations derived from several well-known distribution functions. (Woodard-USGS) W76-03899

STATISTICAL SUMMARIES OF STREAM-FLOW RECORDS, OKLAHOMA, THROUGH 1974, Geological Survey, Oklahoma City, Okla.

Geological Survey, Oklahoma City, Okla. For primary bibliographic entry see Field 7C. W76-03904

HYDROLOGIC UNIT MAP-1974, STATE OF ARIZONA. Geological Survey, Reston, Va. For primary bibliographic entry see Field 7C. W76-03909 HYDROLOGIC UNIT MAP--1974, STATE OF CALIFORNIA.

Geological Survey, Reston, Va. For primary bibliographic entry see Field 7C. W76-03910

DRAINAGE AREAS FOR ILLINOIS STREAMS, Geological Survey, Champaign, Ill. For primary bibliographic entry see Field 7C. W76-03913

OVERSNOW RUNOFF EVENTS AFFECT STREAMFLOW AND WATER QUALITY, Forest Service (USDA), Laramie, Wyo. Forest Range and Watershed Lab. For primary bibliographic entry see Field 4D. W76-03965

HYDROLOGIC RELATIONS ON UNDISTURBED AND CONVERTED BIG SAGEBRUSH LANDS: THE STATUS OF OUR KNOWLEDGE,

KNOWLEDGE,
Forest Service (USDA), Laramie, Wyo. Forest
Range and Watershed Lab.
For primary bibliographic entry see Field 2A.
W76-03967

#### 2F. Groundwater

A PRELIMINARY REPORT ON ANOMALOUS PRESSURES IN DEEP ARTESIAN AQUIFERS IN SOUTHEASTERN NORTH CAROLINA, North Carolina Dept. of Natural and Economic Resources, Raleigh. Div. of Resources Planning and Evaluation.

For primary bibliographic entry see Field 4B. W76-03526

UNSTEADY UNCONFINED FLOW INTO A SURFACE RESERVOIR,

Birmingham Univ. (England). Dept. of Civil Engineering. T. D. Streltsova.

Journal of Hydrology, Vol 27, No 1/2, p 95-110, October 1975. 5 fig, 2 tab, 5 ref.

Descriptors: \*Groundwater, \*Surface-groundwater relationships, \*Groundwater movement, \*Groundwater barriers, Water table aquifers, Porosity, Transmissivity, Compressibility, Reservoirs, Surface waters, Unsteady flow, Streams, Boundaries(Surfaces), Water table, Equations, Flow. Identifiers: Delayed drainaged. Elastic aquifers.

The flow in a vertical plane of a semi-infinite unconfined aquifer into or from a reservoir was considered. The aquifer, the initial state of which is one of uniform head distribution, was subjected to an instantaneous change of the water level at the boundary. Elastic reaction of the aquifer and concomitantly occurring variable vertical movement of flow were taken into account in a response mechanism of the unconfined formation to the water-boundary disturbance. The average drawdown equation and the free surface drawdown equation for flow in a compressible unconfined aquifer were derived. The solutions were presented in a tabulated form and a set of type curves were prepared. (Gibb-ISWS)

LIMESTONE DRAINAGE SYSTEMS, Birmingham Univ. (England). Dept. of Geography. D. P. Ede.

Journal of Hydrology, Vol 27, No 3/4, p 297-318, December 1975. 8 fig, 6 tab, 16 ref.

Descriptors: \*Limestones, \*Drainage systems, \*Groundwater movement, \*Drainage patterns(Geologic), \*Water quality, Sinks, Frac-

turs(Geologic), Karst hydrology, Aquifers, Springs, Spring waters, Water types, Carbonate rocks, Water properties, Hardness(Water). Identifiers: South Wales, \*Resurgence flow, Conduit flow, Sinking streams, Flow networks.

The form of a number of limestone drainage systems on the Gower Peninsula, South Wales, was described. The effect of system morphology on seasonal variation in flow pattern and solute load at spring sites was examined and the systems ordered according to the degree of development of the conduit flow component and the integration of percolation inputs. Reference was made to the development of flow systems in other areas. A projection of the effect of system form on the discharge hydrograph was attempted. Reference was made not only to chemical characteristics but also to mode of operation and systems definition. (Prickett-ISWS)

RESPONSE TESTING OF PIEZOMETERS IN FRACTURED POROUS MEDIA,

Alberta Univ., Edmonton. Dept. of Geology. F. W. Schwartz.

Canadian Geotechnical Journal, Vol 12, No 3, p 408-412, August 1975. 2 fig, 1 tab, 6 ref.

Descriptors: \*Piezometers, \*Testing, \*Water levels, \*Canada, Fractures(Geologic), Porosity, Bedrock, Hydraulic conductivity, On-site data collections, Artesian heads, Pressure, Graphical analysis, Curves, Wells, Volume, Porous media, Equilibrium.

Identifiers: \*Slug test, \*Alberta(Canada), Empirical method.

Conventional methods of piezometer response testing were unsuitable for analyzing observed data from three piezometers placed in fractured coal and siltstone units. However, these responses corresponded closely to the results of pressure tests in fractured limestones (Pollard). Following an extended form of the Pollard analysis, the fracture porosity within fractured coal units was calculated to comprise approximately 3.7% of the total porosity. In the deeper siltstone unit, the fracture porosity made up only 0.5% of the total porosity. The application of basic time lag principles (Hvorslev) to separate segments of the Pollard plot made it possible to determine the hydraulic conductivity of the matrix and fracture systems. The hydraulic conductivity of the fracture system was calcuated to be 40 to 250 times higher than the matrix. (Viscocky-ISWS)

UNDERGROUND WATERS OF THE LOWER HUTT--A MODEL STUDY,
Department of Scientific and Industrial Research,

Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Physics and Engineering Lab.

I. G. Donaldson.

Journal of Hydrology (New Zealand), Vol 13, No 2, p 81-97, 1974. 4 fig. 17 ref.

Descriptors: \*Computer models, \*Groundwater, \*Aquifer systems, \*Groundwater basins, Digital computers, Recharge, Models tudies, Simulation analysis, Unconsolidated aquifers, Water levels, Withdrawal, Surface-groundwater relationships, Aquifers, Water management(Applied). Identifiers: \*Finite difference theory, \*New Zeland, \*Lower Hutt Valley(New Zealand).

A two-dimensional time-dependent computer-based model of the Lower Hutt - Port Nicholson groundwater system has been developed and was described briefly. The model was designed both as a resource and as a management tool in that it has the potential of simulation of the groundwater system under real operating conditions as well as of prediction of drawdown effects under sustained withdrawal conditions of any type likely to be expected in practice. Computer heads throughout the

#### Field 2-WATER CYCLE

#### Group 2F—Groundwater

field over a seven-week period were illustrated and showed the quality of the model as a tool in groundwater behavior simulation. (Sanderson-ISWS) W76-03753

THE FUTURE OF WATER RESOURCES IN NORTHEASTERN ILLINOIS. Illinois State Water Survey, Urbana For primary bibliographic entry see Field 6D.

GROUND-WATER RECHARGE SIMULATION. New South Wales Univ., Kensington (Australia). Faculty of Military Studies. For primary bibliographic entry see Field 4B. W76-03801

THE EFFECT OF SANITARY LANDFILLS ON WATER QUALITY IN SOUTHERN INDIANA, Indiana Univ., Bloomington. Dept. of Geography. For primary bibliographic entry see Field 5B.

APPENDIX 3, GEOLOGY AND GROUND WATER, GREAT LAKES BASIN FRAMEWORK

Great Lakes Basin Commission, Ann Arbor, Michigan , Public Information Office. 1975. 152 p, 60 fig, 15 tab, 244 ref.

Descriptors: \*Great Lakes Region, \*Geology, \*Groundwater, \*Aquifers, \*Illinois, \*Indiana, Descriptors: "Great Lakes Region, "Geology, "Groundwater, "Aquifers, "Illinois, "Indiana, "Michigan, "Minnesota, "New York, "Ohio, "Pennsylvania, "Wisconsin, "Lake Superior, "Lake Michigan, "Lake Huron, "Lake Erie, "Lake Ontario, Hydrogeology, Hydrology, Stratigraphy, Unconsolidated aquifers, Bedrock, Water quality, Lake basins, Geomorphology, Aquifer management, Groundwater potential, Groundwater resources, Data collections, Groundwater hasins Water rights Groundwater basins, Water rights.

The Great Lakes Basin is underlain almost entirely by a thick succession of sedimentary rocks. The major structures include the large Michigan basin and a long, narrow structural platform, extending and a long, narrow structural platform, extending from Indiana to the St. Lawrence Valley. Crystal-line rocks extrude in the western Lake Superior and Adirondack regions. Glacial and alluvial deposits covering the bedrock are as much as 1100 feet thick, with the thickest deposits generally occurring in Michigan and locally in buried bedrock valleys of New York and Wisconsin. The deposits range in composition from clay and silt, through sand and gravel, to boulders which are well sorted or a heterogeneous mixture. Groundwater is present everywhere throughout the Basin, but in limited quantities in areas where the basement rock is at or near the surface. Bedrock aquifers vary in their productivity, but they are more widespread, continuous, and generally more predictable in their potential than unconsolidated aquifers. Carbonate (limestone and dolomite) aquiters. Carbonate (timestone and dolomite) aquifers constitute the most common bedrock aquifers. Chemical quality of groundwater is generally good but varies considerably from area to area. Natural groundwater discharge or runoff was used to estimate basin yield as a means of determining the groundwater potential. Local pol-lution of shallow groundwater supplies is com-mon, but current disposal restrictions will hopefully reverse this trend. Improper well design in multi-aquifer areas, especially where a poot-quality water zone is present, has been a problem in some areas. Unplanned groundwater development has caused problems. (Humphreys-ISWS) W76-03863

EVALUATION AND PROPOSED STUDY OF POTENTIAL GROUND-WATER SUPPLIES, GALLUP AREA, NEW MEXICO, Geological Survey, Albuquerque, N. Mex. For primary bibliographic entry see Field 4B.

W76-03905

THE WATER TABLE ON LONG ISLAND, NEW YORK, IN MARCH 1974, Geological Survey, Mineola, N.Y. For primary bibliographic entry see Field 4B.

HARFORD COUNTY GROUND-WATER IN-FORMATION: WELL RECORDS, CHEMICAL QUALITY DATA, AND PUMPAGE, Geological Survey, Parkville, Md. For primary bibliographic entry see Field 7C. W76-03912

FINITE ELEMENT SOLUTIONS TO TWO GROUNDWATER FLOW PROBLEMS - ONE IN-CLUDING DISPERSION AND THE OTHER THE INFLUENCE OF ELECTRO-OSMOSIS, California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineerin For primary bibliographic entry see Field 5B

#### 2G. Water In Soils

DETACHMENT OF SOIL AGGREGATES BY SIMULATED RAINFALL FROM HEAVILY MANURED SOILS IN EASTERN NEBRASKA, Nebraska Univ., Lincoln. Dept. of Agronomy. For primary bibliographic entry see Field 2J. W76-03730

THE CALCULATION OF STEADY-STATE WATER-TABLE HEIGHTS IN DRAINED SOILS MEANS OF THE FINITE-ELEMENT METHOD,

Cambridge Univ. (England). Dept. of Applied

Biology, A. B. Gureghian, and E. G. Youngs.
Journal of Hydrology, Vol 27, No 1/2, p 15-32, October 1975. 13 fig, 1 tab, 30 ref.

Descriptors: \*Subsurface drainage, \*Soil water, \*Finite element analysis, \*Mathematical studies, \*Numerical analysis, \*Water table, Equations, Steady flow, Drains, Drainage systems, Percola-tion, Soil water movement, Saturated flow, Groundwater, Mathematical models Identifiers: Galerkin method, Method of weighted residuals, Triangular elements.

The use of a Galerkin-type finite-element method for the solution of steady-state drainage problems in both homogeneous and heterogeneous soils was described. The numerical procedure was shown to give satisfactory water-table heights in particular cases of ditch drainage in uniform and layered soils with given incident rainfall. The use of the method in more complex situations was illustrated with an example of a drained layered soil in which the backfill over a pipe drain created a vertical band of soil of different hydraulic conductivity. (Prickett-ISWS) W76-03743

AMOUNT OF WATER NEEDED TO INITIATE FLOW IN RUBBLY ROCK PARTICLES Directorate General of Petroleum and Minerals, Muscat (Oman). I. M. ElBoushi.

Journal of Hydrology, Vol 27, No 3/4, p 275-284, December 1975. 4 fig, 4 tab, 6 ref.

Descriptors: \*Groundwater \*Infiltration, \*Field capacity, \*Retention, \*Gravitational water, Groundwater, Percolating water, Groundwater movement, Zone of saturation, Deep percolation, Soil water movement, Seepage, On-site laboratories, Laboratory tests, Flow, Specific retention, Natural recharge. Identifiers: \*Rubbly rock, Infiltration initiation, Threshold velocities

A WPTSDS1

The amount of water needed to start infiltration and initiate flow was measured for dense, coarse, granular material. Water volumes as low as 0.6-0.1% of total sample volume were needed to start infiltration and cause flow. This does not support the earlier belief, based on studies of fine material, that infiltrating water has to satisfy the field capacity and replenish water of retention before any infiltration can occur. The factor responsible for this dissimilarity is that only the upper surface of a column of gravel wets completely, whereas at a short distance from the surface, the water tends to concentrate in small rivulets that occupy only half or less than half of the material. In addition. not all the particle surfaces are wetted at lower levels. Experiments showed that as little as 20% of the particle surfaces were wetted at lower levels. (Prickett-ISWS)

ANALYSIS OF THE PORE PRESSURE CHANGES FOLLOWING THE EXCAVATION OF A SLOPE

Hardy (R. M.) and Associates Ltd, Edmonton (Alberta). For primary bibliographic entry see Field 8D.

THE HYSTERESIS IN THE RELATIONSHIP BETWEEN HYDRAULIC CONDUCTIVITY AND SOIL WATER CONTENT, Agricultural Research Council, Cambridge

(England). Unit of Soil Physics. A. Poulovassilis, and E. Tzimas

Soil Science, Vol 120, No 5, p 327-331, November 1975. 4 fig. 9 ref.

Descriptors: \*Soil water, \*Soil mois \*Hysteresis, \*Hydraulic conductivity, Pemedia, Drainage effects, Saturation, Wetting. \*Soil moisture,

Experiments designed to study the relationship between the hydraulic conductivity and the water content of a porous body were performed on two inert porous materials packed in long columns. The experimental results obtained were presented. They showed that the relationship is hysteretic and that the repeated variation of the water content between any two limiting values results in a closed hysteretic loop. The relationship was subsequently examined in the light of the domain theory. It was found that the distribution function H for the conductivity elements may be considered as independent of the water contents at which the increment of water content reverses from negative to positive and from positive to negative, respectively, and therefore that the conductivity elements may be considered as independent. Distribution diagrams were obtained from an analysis of the primary depletion curves according to the independent domain concept. The hysteretic pths calcuated by means of these diagrams showed satisfactory agreement with the experimental paths. (Gibb-ISWS) W76-03754

MATHEMATICAL MODEL. FOR PHOSPHORUS MOVEMENT IN SOILS, Michigan State Univ., East Lansing. Dept. of Chemical Engineering. For primary bibliographic entry see Field 5B. W76-03802

THE EFFECT OF SANITARY LANDFILLS ON WATER QUALITY IN SOUTHERN INDIANA, Indiana Univ., Bloomington. Dept. of Geography. For primary bibliographic entry see Field 5B.

Lakes-Group 2H

A MICROSCOPIC-SCALE MODEL OF SOIL WATER UPTAKE AND SALT MOVEMENT TO

WATER UPTAKE AND SALE MOVEMENT OF THE NEW YORK TEXAS A and M Univ., College Station. Dept. of Soil and Crop Sciences.

D. Hillel, C. G. E. M. van Beek, and H. Talpaz.
Soil Science, Vol 120, No 5, p 385-399, November 1975. 14 fig, 20 ref.

Descriptors: \*Numerical analysis, \*Soil water movement, \*Moisture uptake, Salts, Root dis-tribution, Root zone, Computer models, Computer programs, Equations, Pore pressure, Hydraulic conductivity, Salinity, Permeability, Drawdown, Osmotic pressure, Flow rates, Transpiration, Microenvironment, Depth, Solutes.

Identifiers: Radial movement, 'Crown potential', Salt movement

A numerical model, based on the transport equa tions for water and noninteracting solutes and written in IBM S/360 CSMP language, was designed to compute the radial movement of water and salts to plant roots. The inputs were: the soil's suction and conductivity functions, the soil solution's content and concentration, root density and permeability, and the required uptake rate (whether constant or diurnally fluctuating). The output provided the time-dependent drawdown of matric and osmotic potentials in the immediate vicinity of the root, the gradients and flow rates of water and solutes in the soil, and the plant water potentials needed to maintain different uptake rates. The model was illustrated for various root ing densities and various initial water contents and salt concentrations. The effect of increasing root density and permeability was seen to be similar to the effect of increasing water content or reducing transpirational demand. (Visocky-ISWS) W76-03860

APPENDIX 16, DRAINAGE, GREAT LAKES BASIN FRAMEWORK STUDY.

Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 4A.

AN EVALUATION OF THE ACCUMULATION. TRANSLOCATION, AND DEGRADATION OF PESTICIDES AT LAND WASTEWATER DISPOSAL SITES, California Univ., Berkeley. Sanitary Engineering

Research Lab

For primary bibliographic entry see Field 5B. W76-03871

SOIL WATER NITRATE BENEATH A BROAD-

BASIN TERRACED FEEDLOT, Nebraska Univ., Lincoln. Agricultural Experiment Station.

For primary bibliographic entry see Field 5B. W76-03981

STUDIES ON SUBSURFACE MOVEMENT OF EFFLUENT FROM PRIVATE SEWATE DISPOSAL SYSTEMS USING RADIOACTIVE AND DYE TRACERS, PART 2, 1973-74, Ontario Ministry of the Environment, Toronto. For primary bibliographic entry see Field 5B. W76-04000

#### 2H. Lakes

EXPERIMENTALLY INCREASED FISH STOCK IN THE POND TYPE LAKE WARNIAK. IX. NUMBERS AND BIOMASS OF BOTTOM FAIINA

Polish Academy of Sciences, Warsaw. Inst. of

Ecology.

Z. Kajak, and K. Dusoge.

Ekologia Polska, Vol 21, No 35, p 563-571, 1973. 4 fig. 4 tab, 24 ref.

Descriptors: \*Fish stocking, \*Benthic fauna, \*Biomass, Fish population, Fish food organisms, Diptera, Larvae, Oligochaetes. Identifiers: \*Lake Warniak(Poland), Trichoptera,

Ephemeroptera, Heleidae, Sialis lutaria, Odonata, Lepidoptera, Chaoborus, Hirudinea, Asellus

Studies were made in Poland to determine food resources of the bottom zone for fish and to observe the effect of benthos consumption by fish. Chironomidae larvae contributed about 50% of benthic biomass. Biomass was high in spring and autumn and low in summer at all depths and for all fauna groups. When biomass and Chironomidae numbers were low, contribution of small larvae to biomass was greatest. Curves of benthos changes were similar each year, but differences between minimum and maximum were becoming less, average biomass of bottom fauna less, and percentage of Chironomidae total biomass more and that of some other groups less. The lake was moderately abundant in food for benthophagous fish. The average weight of individual larvae in-creased with depth. No differences were observed in occurrence of bottom fauna in different parts of the lake because fences were not tight so fish den-sity was dispersed. The disappearance of big benthic worms in the last years of the studies, at the highest fish pressure, and the decrease in benthic biomass, show that fish feeding was the main reason for the changes in benthos. A decrease in primary production may also have occurred due to fish activity. (Buchanan-Davidson--Wisconsin) W76-03539

LAKE HAKOJARVI, A POLYHUMIC LAKE IN SOUTHERN FINLAND,

For primary bibliographic entry see Field 5C.

INDIANA DUNES NATIONAL LAKESHORE (S

For primary bibliographic entry see Field 6E.

ENVIRONMENTAL FACTORS AFFECTING THE STRENGTH OF WALLEYE (STIZOSTEDION VITREUM VITREUM) YEAR CLASSES IN WESTERN LAKE ERIE, 1960-70, Bureau of Sport Fisheries and Wildlife, Sandusky,

Ohio. Biological Station. For primary bibliographic entry see Field 5C. W76-03653

SIGNIFICANCE OF DETRITUS OR DETRITUS-ASSOCIATED INVERTERRATES TO FISH PRODUCTION IN A NEW IMPOUNDMENT, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and, Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.

For primary bibliographic entry see Field 5C. W76-03654

YELLOW PERCH (PERCA FLAVESCENS) BIOMASS RESPONSES TO DIFFERENT LEVELS OF PHYTOPLANKTON AND BENTHIC BIOMASS IN LAKE MEMPHREMAGOG, QUEBEC-VERMONT, McGill Univ., Montreal (Quebec). Dept. of Biolo-

For primary bibliographic entry see Field 5C.

INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES.

National Oceanic and Atmospheric Administration, Rockville, Md. International Field Year for the Great Lakes

(IFYGL) Bulletin No. 16, November 1975. 105 p, 12 fig, 6 tab.

Descriptors: \*Great Lakes, \*International waters, \*International Hydrological Decade, \*Canada, \*United States, \*Lake Ontario, Programs, Publications, Bibliographies, Water temperature, Air temperature, Data processing, Currents(Water), Dew point, Temperature.

Identifiers: International Field Year for the Great

Listed were the official International Field Year for the Great Lakes (IFYGL) publications, joint Canadian-U.S. publications included in IFYGL Bulletin No. 15, and additions to the IFYGL bibliography. Nine abstracts of Canadian-authored IFYGL papers were included. U.S. information presented for Lake Ontario included monthly lake precipitation totals for 26 and 23 station networks; November 1972 daily lake precipitation totals; monthly wind histograms of wind 3 to 4 m above the lake surface for May through November; stathe lake surface for May Inrough November; sta-tion locations for physical data collection system; and examples of rawinsonde data, water current direction, water temperature, air temperature, dew point temperature, and barometric pressure. Brief reports on both Canadian and U.S. scientific projects were included. Canadian and U.S. sum maries of data available from final IFYGL archives were tabulated. (Humphreys-ISWS) W76-03725

INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES.

National Oceanic and Atmospheric Administration, Rockville, Md.

International Field Year for the Great Lakes (IFYGL) Bulletin No. 15, August 1975. 103 p, 16 fig. 9 tab.

Descriptors: \*Great Lakes, \*International waters, \*International Hydrological Decade, \*Canada, \*United States, \*Lake Ontario, Programs, Publications, Bibliographies, Water temperature, Currents(Water), Lakes, Lake stages, Water levels, Evaporation, Water loss. Identifiers: International Field Year for the Great

Lakes

Listed were the official Internationl Field Year for Canadian-U.S. publications included in IFGYL Bulletin No. 14, and additions to the IFYGL bibliography. Abstracts of size C. bibliography. Abstracts of nine Canadian-authored papers presented at the 18th Conference on Great Lakes Research in May 1975, Albany, N.Y., were included. U.S. information presented for Lake Ontario included monthly mean temperatures, monthly mean current speed, weighting factors and beginning-of-month water levels for ten gaging stations, lake storage, lake evaporation, and monthly resultant lake currents at 15m and 30m depths for May 1972 through October 1972. Brief reports on both Canadian and U.S. scientific projects were included. Canadian and U.S. summaries of data available from final IFYGL archives were tabulated. (Humphreys-ISWS) W76-03726

LATERAL MOMENTUM FLUX IN BOUNDARY CURRENTS.

Woods Hole Oceanographic Institution, Mass. G. T. Csanady.

Journal of Physical Oceanography, Vol 5, No 4, p 705-717, October 1975. 8 fig, 24 ref. NOAA 03-5-022-26, Brookhaven Nat. Lab. 32537-S.

Descriptors: \*Currents(Water), \*Momentum transfer, \*Lakes, \*Great Lakes, \*Oceans, Circulation, Ocean currents, Flow, Winds, Model studies, Mathematical models, Oceanography Identifiers: \*Boundary currents.

Some simple momentum advection effects were considered in a current aligned with the y axis on which there was superimposed a 'cross' flow in the x-z plane. The cross flow coupled with horizontal shear in the current tends to generate

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#### Group 2H-Lakes

differences along the vertical in the longshore velocity, while vertical mixing tends to even out such differences. A balance is possible between the two tendencies. The equilibrium velocity distribution may support considerable lateral memen-tum flux, which, in the case of zero rotation, is directed down the velocity gradient, allowing the definition of an effective horizontal viscosity. When rotational effects are significant, both the sense and the magnitude of the momentum flux come to depend in a complex way on the total vorticity. Some illustrative examples were calculated for cross flow produced by frictional effects in a boundary current. These showed that horizontal momentum flux by this type of cross flow can be significant in shallow water under some circum-stances. A consideration of observational evidence from the Great Lakes lead to the conclusion that this mechanism of momentum transfer may well be responsible for the observed asymmetry of wind-generated coastal jets, i.e., the strengthening of the 'right-hand' jet (looking along the wind) at the expense of the left-hand jet. (Sims-ISWS) W76-03732

LAKE ONTARIO MEAN TEMPERATURES AND CURRENTS IN JULY 1972,

National Oceanic and Atmospheric Administra-tion, Ann Arbor, Mich. Great Lakes Environmental Research Lab

R. L. Pickett, and F. P. Richards.

Journal of Physical Oceanography, Vol 5, No 4, p 775-781, October 1975. 10 fig, 1 tab, 8 ref.

Descriptors: \*Air temperature, \*Currents(Water), \*Wind velocity, \*Lake Ontario, \*Water temperature, \*Density stratification, Thermocline, Lake breezes, Climatic data, Meteorology, Surface

waters, Air circulation.

Identifiers: \*Cyclonic flow, \*Temperature spectrum, \*Perturbations.

Monthly mean air and water temperatures and winds and currents were calculated for Lake On-tario for July 1972 from data collected during the International Field Year for the Great Lakes. The mean air temperature pattern was similar to the lake surface temperature pattern except in the northwestern part of the lake due to warm air around Toronto. Surface water temperatures showed warm water (greater than 19C) along the south-central shore and a cold pocket (16C) in the northwest. A subsurface cold pocket also occurred near the middle of the lake. Maximum perturbations of the mean temperature field occurred near the surface and thermocline at the lowest frequencies (less than 0.02 cycle/h). The diurnal temperature signal was significant near the surface, and the inertial signal was significant near the thermocline. Winds were from the west at about 3 m/s. In response, the thermocline tilted from 5 m along the northwestern shore to 14 m along the southern shore of the lake. Monthly resultant currents in-dicated cyclonic flow at all depths and a northbound flow off Rochester in the region of a bottom ridge. Observed currents were consistent with geostrophic calculations. Maximum current perturbations occurred near the surface at the lowest frequencies and at the inertial frequency. (Lardner-ISWS) W76-03740

OUTPUT FROM A CASCADE OF DISCRETE LINEAR RESERVOIRS WITH STOCHASTIC

Department of Environment, Ottawa (Ontario). Hydrology Research Div. For primary bibliographic entry see Field 2E.

W76-03742

SESTON COMPOSITION IN THE POINT PELEE AREA OF LAKE ERIE, Lake Erie Fisheries Research Station, Wheatley (Ontario).

For primary bibliographic entry see Field 5C.

W76-03787

SEMI-INFINITE SOLID MODEL FOR PREDIC-TION OF TEMPERATURE IN DEEP RESER-VOIRS AND LAKES,

Arkansas Univ., Fayetteville. Dept. of Chemical Engineering. L. J. Thibodeaux.

Water Resources Bulletin, Vol 11, No 3, p 449-454, June 1975. 2 fig, 1 tab, 5 ref. OWRT A-026-ARK(1).

Descriptors: \*Lakes, \*Reservoirs, \*Thermal properties, \*Hydrothermal studies, \*Model studies, Heat flow, Heat transfer, Heat budget, Thermocline, Stratification, Epilimnion, Air-water interfaces Identifiers: Metalimnion, Hydrolimnion.

A lake or reservoir, heated mainly through the airwater interface, was visualized as a solid which is bounded by the interface plane (x = 0) and extends to infinity in the positive x-direction. Analytical expressions gave the surface temperature, the temperature profile (with depth), and the position of the thermocline as a function of time (Julian Day). Preliminary model results indicated that the general shape of the temperature profile and the position of the thermocline were influenced primarily by the air-water heat exchange and the time lapse since an isothermal condition existed in the water body. (Jess-ISWS)

APPENDIX 2, SURFACE WATER HYDROLOGY, GREAT LAKES BASIN FRAMEWORK STUDY.

Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office For primary bibliographic entry see Field 2E. W76-03862

APPENDIX 3, GEOLOGY AND GROUND WATER, GREAT LAKES BASIN FRAMEWORK

Great Lakes Basin Commission, Ann Arbor, Michigan , Public Information Office. For primary bibliographic entry see Field 2F. W76-03863

APPENDIX 7, WATER QUALITY, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 5A.

APPENDIX 11. LEVELS AND FLOWS, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office For primary bibliographic entry see Field 4A. W76-03865

APPENDIX 12, SHORE USE AND EROSION, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office For primary bibliographic entry see Field 2J. W76-03866

APPENDIX 14, FLOOD PLAINS, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 4A. W76-03867

APPENDIX 15, IRRIGATION, GREAT LAKES BASIN FRAMEWORK STUDY.

Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 3F. W76-03868

APPENDIX 16, DRAINAGE, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 4A. W76-03869

APPENDIX 18, EROSION AND SEDIMENTA-TION, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 2J. W76-03870

A LATE HOLOCENE POLLEN RECORD FROM PEARSON'S POND, WEEKS CREEK LAND-SLIDE, SAN FRANCISCO PENINSULA, SLIDE, SAN CALIFORNIA. Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 2I.

HYDROLOGY OF MALHEUR LAKE HARNEY COUNTY, SOUTHEASTERN OREGON, Geological Survey, Portland, Oreg. For primary bibliographic entry see Field 4A. W76-03906

#### 2I. Water In Plants

W76-03896

TRITIUM FRACTIONATION IN PLANTS, Environmental Monitoring and Support Lab., Las Vegas, Nev. Monitoring Systems Research and Development Div. For primary bibliographic entry see Field 5A. W76-03632

A MICROSCOPIC-SCALE MODEL OF SOIL WATER UPTAKE AND SALT MOVEMENT TO PLANT ROOTS. Texas A and M Univ., College Station. Dept. of

Soil and Crop Sciences. For primary bibliographic entry see Field 2G. W76-03860

A LATE HOLOCENE POLLEN RECORD FROM PEARSON'S POND, WEEKS CREEK LAND-SLIDE, SAN FRANCISCO PENINSULA, CALIFORNIA,

Geological Survey, Menlo Park, Calif. D. P. Adam

Journal of Research of the U.S. Geological Survey, Vol 3, No 6, p 721-731, November-December 1975. 6 fig, 2 tab, 23 ref.

\*Dating, \*Moisture \*Geologic time, \*Palynology, \*California, Pollen, Distribution patterns, Sampling, Cores, Data col-lections, Climatology, \*Ponds. Identifiers: \*Sam Francisco Peninsula(Calif), Identifiers: \*San Francisco \*Late Holocene, \*Pollen types.

A 210-cm core from Pearson's Pond on San Francisco Peninsula, Calif., yielded a pollen record for the past 3 millenia. Prior to A.D. 1000 the pond biota was particularly sensitive to climatic fluctuations. Two wet intervals occur in the pollen record, between 350 B.C. and A.D. 0 and between A.D. 650 and 900. The pollen record suggests that the Weeks Creek landslide may have moved at least twice prior to 3,000 years ago and that the middle part of the slide has been stable since that

#### Erosion and Sedimentation—Group 2J

time. Seasonal changes produce large annual fluctuations in the water table, and climatic changes during the past 3,000 years have produced significant changes in the timing and magnitude of the annual changes. Climatic records such as the one presented here will help us to understand and separate the effects of climate and earthquakes on the landslide history of the Holocene deposits of the San Francisco Bay area. (Woodard-USGS) W76-03896

A LATE HOLOCENE POLLEN DIAGRAM FROM NEAR LAKE TAHOE, EL DORADO COUNTY, CALIFORNIA,

Slovenska Akademija Znanosti in Umetnosti, Ljublijana (Yugoslavia); and Geological Survey, Menlo Park. Calif.

A. Sercelj, and D. P. Adam. Journal of Research of the U.S. Geological Survey, Vol 3, No 6, p 737-745, November-December 1975. 4 fig. 2 tab, 18 ref.

Descriptors:

\*Precipitation(Atmospheric), \*Geologic time, Pralynology, \*California, Pollen, Distribution patterns, Sampling, Cores, Data collections, Climatology.

Identifiers:

\*Sierra Nevada(Calif), \*Late Holocene, Pollen records, \*Pollen types.

A 2,500-yr pollen record from an alpine meadow in the central Sierra Nevada, California, shows a general agreement with other more detailed pollen records from the late Holocene of California. Tree roots from the site suggest dry conditions at about 1150 and 1350 radiocarbon yr B.P. The site was sampled during the summers of 1971, 1972, and 1973. Several small springs keep the site moist during the dry summer months. The drainage area feeding these springs is rather small, extending from the site to the crest of the range; with the most distant part of the drainage basin only about 0.5 km to the south of the springs. The discharge of the springs, as reflected by peat growth and the pollen record of the surrounding vegetation, should therefore provide a good measure of changes in the precipitation regime at the crest of the Sierra Nevada. (Woodard-USGS)

#### 2J. Erosion and Sedimentation

DETACHMENT OF SOIL AGGREGATES BY SIMULATED RAINFALL FROM HEAVILY MANURED SOILS IN EASTERN NEBRASKA, Nebroack Livin, Lingual Dart of Agronomy.

Nebraska Univ., Lincoln. Dept. of Agronomy. A. P. Mazurak, L. Chesnin, and A. E. Tiarks. Soil Science Society of America Proceedings, Vol 39, No 4, p 732-736, July-August 1975. 3 fig, 3 tab, 13 ref. OWRT B-012-NEB(4).

Descriptors: \*Soil compaction, \*Erosion, \*Nebraska, Simulated rainfall, Erosion rates, Feed lots, Raindrops, Rainfall intensity, Aggregates, Cultivation, Farm wastes, Particle size, On-site investigations.

Identifiers: \*Tillage depth, \*Manured soil, Soil detachment, Manure, Splash erosion, Aggregate size distribution, Soil crust strength.

A field experiment was established to measure the effects of annual applications of high rates of manure for the production of crops under irrigation. The effects of incorporating the manure into the soil by disk plowing to depths of 10 cm, 20 cm, and 30 cm on the stability of the soil mass was measured under simulated rainfall conditions. The effect of simulated rainfall on soil surface compaction as influenced by rate of application of manure and depth of incorporation was measured with a penetrometer. The amount of soil material detached from undisturbed soil cores by simulated raindrops was curvilinearly related to the rainfall intensity. When the plots were disk plowed to a depth of 10 cm, soil detachment increased from 55

mg/ cu cm of water for the nonmanured plots to 89 mg/cu cm for the 415 metric tons/ha per year. The amount of soil particles detached by the raindrops was reduced about 15 mg/cu cm of water as the depth of disking manure into the soil was increased from 10 to 30 cm. Aggregate size distribution of the splashed material showed that prior application of manure to the soil increased the amount of soil aggregates in the large diameter classes. The penetrometer resistance of the crust formed by the waterdrops decreased from 36 kg/sq cm for nonmanured plots to 4.4 kg/sq cm for the plots receiving 360 metric tons of manure/ha/year. (Lee-ISWS)

STORMFLOWS AND EROSION AFTER TREE-LENGTH SKIDDING ON COASTAL PLAIN SOILS

SOILS, Forest Service (USDA), Oxford, Miss. Southern Forest Experiment Station. For primary bibliographic entry see Field 4C. W76.03756

THE MACRO-INVERTEBRATE FAUNA OF THE INTERTIDAL SOFT SEDIMENTS OF SOUTH EAST ENGLAND, Institute of Terrestrial Ecology, Norwich (England). Colney Research Station.

(England). Colney Research Station. For primary bibliographic entry see Field 5B. W76-03764

SESTON COMPOSITION IN THE POINT PELEE AREA OF LAKE ERIE, Lake Erie Fisheries Research Station, Wheatley

Contario).
For primary bibliographic entry see Field 5C.
W76-03787

THE SIZE AND SHAPE OF SMALL-SCALE CURRENT RIPPLES: AN EXPERIMENTAL STUDY USING MEDIUM SAND,

Keele Univ. (England). Dept. of Geology. N. L. Banks, and J. D. Collinson. Sedimentology. Vol 22, No 4, p 583-599, November 1975. 10 fig, 3 tab, 9 ref, 1 append.

Descriptors: \*Particle size, \*Particle shape, \*Ripple marks, Froude number, Roughness(Hydraulic), Turbulence, Turbulent flow, Sediment transport, Flumes, Reynolds number, Hydraulics, Sediment-water interfaces, Laboratory tests.

Laboratory tests.
Identifiers: Cumulative grain size, Ripple chordlength, Ripple height, Ripple index.

Flume experiments with medium sand confirmed the increasing complexity in the shape of small-scale current ripples with increasing flow velocity for constant depth. Experiments suggested that a measure of ripple shape (transverse to streamwise features) has a more complex relationship with the flow property (Froude Number and relative roughness), than was previously realized. It was suggested that hydraulic properties of the flow at the sediment water interface have a more general relationship with ripple form than do properties of the whole flow such as Froude and Reynolds Numbers. Properties of the whole flow tend to separate data into depth-related curves at shallow flows where the free water surface influences the structure of the turbulence. (Lee-ISWS)

AN EVALUATION OF CM PATTERNS FOR GRAIN-SIZE STUDIES OF FINE GRAINED SEDIMENTS.

Louvain Univ. (Belgium). Laboratorium voor Sedimentologie.

N. Vanderberghe. Sedimentology, Vol 22, No 4, p 615-622, November 1975. 4 fig, 10 ref. Descriptors: \*Particle size, \*Sediment transport, Particle shape, Suspended solids, Suspended load, Clays, Sedimentation, Sediments, Hydraulics. Identifiers: \*Grain-size distribution, \*Boom clay(Belgium), Clay-rich sediments, Transport mechanism.

Grain-size data of Boom clay (Belgium) were represented on diagrams of: (1) the coarsest one percentile value-the median value, (2) the finer 2 micrometer percentile value-the median value, and (3) the finer 32 micrometer percentile value-the median value, as suggested by Passega. They showed a typical 'uniform suspension' pattern. It was argued that a 'uniform suspension' pattern can be due simply to the clay-rich nature of the sediments. As these sediments are not deposited by a single transport mechanism, the 'uniform suspension' pattern does not necessarily indicate a specific transport mechanism. (Lee-ISWS) W76-03855

STREAM CHANNEL MEASUREMENTS IN NEW ZEALAND,
Victoria Univ., Wellington (New Zealand). Dept.

Victoria Univ., Wellington (New Zealand). Dept. of Geography. For primary bibliographic entry see Field 7A. W76-03856

LOCAL EROSION CAUSED BY RAPID FORCED INFILTRATION,

Aberdeen Univ. (Scotland). Dept. of Engineering. B. B. Willetts, and M. E. Drossos. Journal of the Hydraulics Division, American

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 101, No HY12, Proceedings Paper 11796, p 1477-1488, December 1975. 6 fig, 8 ref, 2 append.

Descriptors: \*Stream erosion, \*River beds, \*Alluvial channels, Europe, Bed load, Hydraulics, \*Infiltration, Open channel flow, Rivers, Sediment transport, Seepage, Dunes, Intakes, Hydraulic structures, Hydraulic models, Sedimentation rates, Traction.

Identifiers: \*Suction, Streambed stability, Ripple regime, Boundary shear stress.

Examination of the stream bed over a water intake buried beneath it revealed a scoured hole with a dune downstream. Laboratory experiments resulted in the same kind of feature, providing the bed material is too penetrative to ripple. Theoretical treatment based on momentum changes in the suction zone and limited to two dimensions reproduced, with reasonable success, the behavior of beds of medium sand in a narrow laboratory flume. Grains move faster in the suction zone than elsewhere and their increased reluctance to settle is offset by increased stability of the stationary grains. A stable bed feature is arrived at when these two effects are so balanced that the transport rate of bed load is the same in the suction zone as elsewhere. (Lee-ISWS)

SEDIMENT MOVEMENT AND FRICTION IN ALLUVIAL STREAMS,

ALLUVIAL STREAMS, Nigeria Univ., East Central State. Dept. of Agricultural Engineering. C. G. Ilo.

C. G. 10.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 101, No HY12, p1559-1566, December 1975. 3 fig, 12 ref.

Descriptors: \*Sediment transport, \*Sedimentation rates, River beds, Alluvial channels, Bed load, Hydraulics, Open channel flow, Shear stress, Sediment discharge, Froude number, Particle size, Suspended load, Dunes, Sands.

Suspended load, Dunes, Sands.
Identifiers: \*Total sediment load, \*Alluvial streams, Bed forms, Shields' diagram, Friction factor.

Total bed material discharge was treated, rather than separate estimates of suspended and bed

#### Field 2-WATER CYCLE

#### Group 2J-Erosion and Sedimentation

transport. Most hydraulic problems associated with sediment transport can be more effectively solved by considering total sediment discharge because of the uncertainties in finding when or where the sediments are being transported as suspended, or bed load, especially in the presence of bed forms. Available laboratory and field data of canals and natural rivers, involving a reasonably wide variety of sediment and stream characteristics, were used to illustrate the applicability of the function: they include the geometric mean diameter of 0.09 mm-7.60 mm and river depths of up to 11.5 m. A proposal was also included for forecasting bed form regimes under different flow and sediment characteristics. The following conclusions were reached: (1) Froude number and shear stress ratio appear to be adequate parameters for determining bed form regimes; (2) Shields' scour function may be represented mathematically by simple regression equations; (3) friction factor in alluvial streams in function of the shear-velocity-particle-diameter Reynolds number; and (4) the total sediment discharge of alluvial streams may be adequately determined by very simple equations which consider the Froude number, the specific gravity of the sediment, particle size, and stream slope as the dominant factors. (Lee-ISWS)

EFFECT OF FLOW RATE AND CANOPY ON RILL EROSION,

Agricultural Research Service, Oxford, Miss.

Sedimentation Lab.

L. D. Meyer, G. R. Foster, and S. Nikolov. Transactions of the American Society of Agricultural Engineers, Vol 8, No 5, p 905-911, September-October 1975. 7 fig, 3 tab, 18 ref.

Descriptors: \*Flow rates, \*Canopy, \*Erosion, \*Rill erosion, Channels, Soil erosion, Runoff, Raindrops, Rain, Sediment load, Inflow, On-site investigations, Shear stress, Aggregates, Rainfall intensity, Discharge(Water).

Identifiers: Soil detachment, Tillage marks, Raindrop impact, Headcuts, Knickpoints, Interrill ero-

The influence of flow rate on rill erosion was determined from field studies. The data suggested that rill erosion does not begin until flow reaches a critical rate, and equations incorporating this concept were fitted to the experimental data. Observations and further analyses indicated that rill erosion might be separated into rill shear and rill head-cut components with separate terms for each. Relationships using independently evaluated rill and interrill erosion components were compared with the relationship used for the slope-length factor in the Universal Soil Loss Equation. They agreed quite well for slope lengths up to about 45 m but diverged considerably at greater lengths. This research was conducted at temperatures near freezing and at only one slope steepness and soil condition; thus the results were primarily indicative. (Roberts-ISWS)

APPENDIX 12, SHORE USE AND EROSION, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. 1975. 173 p. 22 fig. 46 tab, 30 maps, 34 ref, 2 append.

Descriptors: \*Great Lakes, \*Shore protection, \*Erosion, \*Waves(Water), \*Costs, \*Great Lakes Region, Erosion control, Islands, Winds, Regulation, Damages, Flood damage, Shores, Lakes, Management, Planning, Lake shores, Land use. Identifiers: \*Shoreland planning and management.

This appendix is a study of the United States shorelands and islands of the Great Lakes. The report described in detail the composition of the shorelines, locations of structural development areas, forested lands, recreational areas, and various distinct physical characteristics. The existence of fish and wildlife, marshes, history of the lakes and shorelines, and physical characteristics of the islands were also described. It was pointed out that shore erosion is the major problem along the Great Lakes shoreland. Wind-generated wave action caused greatest amount of erosion damage, although seepage, frost and ice action, and surface runoff caused some erosion covers 70% or 2500 miles of the Great Lakes shore. Various preventive and regulatory measures were discussed to develop a workable shoreland planning and management program. The cost of the shore protection was estimated to be \$100 to \$500 per foot of shoreline. (Bhowmik-ISWS)

APPENDIX 18, EROSION AND SEDIMENTA-TION, GREAT LAKES BASIN FRAMEWORK STUDY

Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. 1975. 127 p, 50 fig, 47 tab, 42 ref.

Descriptors: \*Great Lakes Region, \*Erosion, \*Sedimentation, \*Illinois, \*Indiana, \*Michigan, \*Minnesota, \*New York, \*Ohio, \*Pennsylvania, \*Wisconsin, Erosion rates, Channel erosion, Sheet erosion, Bank erosion, Wind erosion, Cities, Erosion control, Basins, Data collections, Suspended load, Sedimentation rates, Reservoir silting, Land, Agriculture, Forests, Dredging, Harbors, Navigation, Water quality, Geomorphology, Organic matter.

This report surveys the phenomena of erosion and sedimentation processes as they occur in the Great Lakes Region. Local mean rates of erosion from various sources (sheet erosion, channel erosion, bank erosion, and urban construction) were quantified. Resulting rates of sedimentation and other damages were explored. A major aspect of this study was the presentation of future trends in erosion and sedimentation rates. These rates, based upon economic projections of land needs for crop production and urban expansion, were presented by Basin planning subarea. Future needed amounts of erosion control measures on rural lands were analyzed, and the acres of urbanizing land needing erosion protection were presented. Limitations of existing programs to reduce erosion and sedimentation to levels acceptable for future needs were surveyed. Alternative methods and procedures were discussed, and general recommendations for future action were expressed. The physical characteristics of the various planning subareas in the Basin, as they relate to effects on erosion and sedimentation rates, were defined. (Humphreys-ISWS) W76-03870

SUSPENDED SOLIDS IN WATER.
Office of Naval Research, Arlington, Va. Ocean
Science and Technology Div.
For primary bibliographic entry see Field 2L.
W76-03876

PRINCIPLES OF STUDYING SUSPENDED MATERIALS IN WATER, Delaware Univ., Lewes. Coll. of Marine Studies. For primary bibliographic entry see Field 2L.

W76-03877

STOKES' SETTLING AND CHEMICAL REACTIVITY OF SUSPENDED PARTICLES IN NATURAL WATERS,
Northwestern Univ., Evanston, Ill. Dept. of

Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences. For primary bibliographic entry see Field 2L. W76-03878 BEAM TRANSMISSOMETERS FOR OCEANO-GRAPHIC MEASUREMENTS, Scripps Institution of Oceanography, San Diego,

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Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab. For primary bibliographic entry see Field 2L.

VOLUME-SCATTERING FUNCTIONS IN OCEAN WATERS, Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab. For primary bibliographic entry see Field 2L.

MIE-THEORY MODELS OF LIGHT SCATTER-ING BY OCEAN PARTICULATES, Miami Univ., Coral Gables, Fla. Dept. of Physics. For primary bibliographic entry see Field 2L. W76-0381

SPATIAL DISTRIBUTION OF THE INDEX OF REFRACTION OF SUSPENDED MATTER IN THE OCEAN, Oregon State Univ., Corvallis. School of Oceanog-

For primary bibliographic entry see Field 2L.
W76-03882

ABSOLUTE CALIBRATION OF A SCAT-TERANCE METER, Texas A and M Univ., College Station, Dept. of

Texas A and M Univ., College Station. Dept. of Physics. For primary bibliographic entry see Field 2L. W76-03883

EFFECTS OF TROPICAL STORM AGNES ON THE SUSPENDED SOLIDS OF THE NORTHERN CHESAPEAKE BAY, Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst. For primary bibliographic entry see Field 2L. W76-03884

DISTRIBUTION AND TRANSPORT OF SUSPENDED PARTICULATE MATTER IN SUB-MARINE CANYONS OFF SOUTHERN CALIFORNIA,

National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.; and National Oceanic and Atmospheric Administration, Miami Fla. Marine Geology and Geophysics Lab. For primary bibliographic entry see Field 2L. W76-03885

CONTINUOUS LIGHT-SCATTERING PROFILES AND SUSPENDED MATTER OVER NITINAT DEEP-SEA FAN, Washington Univ., Seattle. Dept. of Oceanogrphy. For primary bibliographic entry see Field 2L.

PHYSICAL, CHEMICAL, AND OPTICAL MEASURES OF SUSPENDED-PARTICLE CONCENTRATIONS: THEIR INTERCOMPARISON AND APPLICATION TO THE WEST AFRICAN SHELF,

University of South Florida, St. Petersburg. Dept. of Marine Science.
For primary bibliographic entry see Field 2L.
W76.0387

THE DISTRIBUTION OF PARTICULATE MATTER IN A NORTHWEST AFRICAN COASTAL UPWELLING AREA, Copenhagen Univ., Denmark. Inst. of Physical Oceanography.
For primary bibliographic entry see Field 2L. W76.03884

THE SUSPENDED MATERIAL OF THE AMAZON SHELF AND TROPICAL ATLANTIC

Delaware Univ., Lewes. Coll. of Marine Studies. For primary bibliographic entry see Field 2L.

TURBIDITY DISTRIBUTION IN THE DEEP WATERS OF THE WESTERN ATLANTIC

Geological Palisades, N.Y. For primary bibliographic entry see Field 2L.

W76-03890

W76-03892

VARIATIONS IN BENTHIC BOUNDARY LAYER PHENOMENA: NEPHELOID LAYER IN THE NORTH AMERICAN BASIN, amont-Doherty Geological

Palisades, N.Y. For primary bibliographic entry see Field 2L. W76-03891

DISTRIBUTION OF SUSPENDED PARTICLES IN THE EQUATORIAL PACIFIC OCEAN Oregon State Univ., Corvallis. School of Oceanog-For primary bibliographic entry see Field 2L.

SUSPENDED MATTER AND THE STABILITY OF THE WATER COLUMN: CENTRAL CARIB-

Texas A and M Univ., College Station. Dept. of Oceanography.

For primary bibliographic entry see Field 2L. W76-03893

LIGHT-SCATTERING MEASUREMENTS AND CHEMICAL ANALYSIS OF SUSPENDED MATTER IN THE NEAR-BOTTOM NEPHE-LOID LAYER OF THE GULF OF MEXICO, Texas A and M Univ., College Station. Dept. of

Oceanography For primary bibliographic entry see Field 2L. W76-03894

LIGHT SCATTERING AND SUSPENDED PARTICULATE MATTER ON A TRANSECT OF THE ATLANTIC OCEAN AT 11 DEG N, University of South Florida, St. Petersburg. Dept. of Marine Science. For primary bibliographic entry see Field 2L. W76-03895

RUNOFF EVENTS STREAMFLOW AND WATER QUALITY,
Forest Service (USDA), Laramie, Wyo. Forest Range and Watershed Lab. For primary bibliographic entry see Field 4D.

SEDIMENT TRANSPORT SAGEBRUSH WATERSHEDS. FROM BIG Forest Service (USDA), Laramie, Wyo. Forest Range and Watershed Lab. For primary bibliographic entry see Field 4D. W76-03966

#### 2K. Chemical Processes

LEAD ISOTOPIC SYSTEMATICS AND AGES OF ARCHAEAN ACID INTRUSIVES IN THE KALGOORLIE-NORSEMAN AREA, WESTERN

AUSTRALIA,
Australian National Univ., Canberra. Research
School of Physical Sciences. V. M. Oversby.

Geochimica et Cosmochimica Acta, Vol 39, No 8, p 1107-1125, 1975. 11 fig, 10 tab, 51 ref.

Descriptors: \*Heavy metals, \*Lead radioisotopes, "Uranium radiosiotopes, "Geologic time, "Geological surveys, Geomorphology, Geology, Systematics, Age, Geologic history, Mass spec-trometry, Anion exchange, Rocks, Rock properties, Chemical precipitation, Mineralogy, Australia

Identifiers: Isochrons, Kalgoorlie-Norseman Area(Western Australia), Intrusions, Crustal history, Plutonic rocks, Geological dataing, K-feldspar, Plagioclase, Magma generation, Continental crust, Greenstone belts, Cratonic regions.

Lead-lead mineral isochrons consisting of K-feldspar, plagioclase, and total rock have been determined for eight intrusive bodies in the Kalgoorlie-Norseman area of Western Australia. The ages found range from 2630 to 2760 million years. Variation of initial lead isotopic composition within plutons has been identified in two cases. For the remaining plutons, whole rock lead-lead isochrons give the same age as the mineral isochrons. Attempts to determine uranium-lead ages reveal largescale loss of uranium from surface rocks in recent times. The initial lead isotopic composition of the intrusions shows that the source regions for the plutonic magmas must have experienced multistage histories prior to magma generation. The time integrated micron value for the source region in all cases exceeds the mean micron value for the Earth. Multistage medel calculations show that continental type rocks must have been present in the Norseman area as early as 3300 million years ago. Original formation of continental crust near Kalgoorlie either occurred much later than at Norseman, or consisted of more basic rock types. The rock samples were crushed, dissolved in acid, purified by anion exchange, and analyzed by mass spectrometry. (Davis-Vanderbilt) W76-03642

HEAVY METAL BINDING COMPONENTS OF

RIVER WATER, Ottawa Univ. (Ontario). Dept. of Biology For primary bibliographic entry see Field 5A. W76-03651

CONTRIBUTIONS TO THE CHEMISTRY OF ANTARCTIC SNOW: DETERMINATION OF TRACE ELEMENTS AT THE PPB LEVEL BY ATOMIC ABSORPTION SPECTROMETRY, Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire de Glaciologie. For primary bibliographic entry see Field 2C. W76-03728

CONTRIBUTION TO THE CHEMISTRY OF AN-TARCTIC SNOW: TRACE ELEMENT DOSAGE BY NEUTRON ACTIVATION,

Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire de Glaciologie. For primary bibliographic entry see Field 2C. W76-03729

STOKES' SETTLING AND CHEMICAL REAC-TIVITY OF SUSPENDED PARTICLES IN NATU-RAL WATERS, Northwestern Univ., Evanston, Ill. Dept. of

Geological Sciences. For primary bibliographic entry see Field 2L. W76-03878

HYDROLOGY OF MALHEUR LAKE, HARNEY COUNTY, SOUTHEASTERN OREGON, Geological Survey, Portland, Oreg. For primary bibliographic entry see Field 4A. W76-03906

WATER QUALITY IN RHODE RIVER AT SMITHSONIAN INSTITUTION PIER NEAR AN-MARYLAND. NAPOLIS. APRIL. THROUGH DECEMBER 1973, Geological Survey, Edgewater, Md. Chesapeake For primary bibliographic entry see Field 5A. W76-03914

METHODS FOR COLLECTION AND ANALYSIS OF AQUATIC BIOLOGICAL AND MICROBIOLOGICAL SAMPLES, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 5A. W76-03915

#### 2L. Estuaries

POTENTIAL EFFECTS OF AQUACULTURE ON INSHORE COASTAL WATERS. Virginia Univ., Charlottesville. Dept. of Environmental Sciences For primary bibliographic entry see Field 5C. W76-03585

INLAND BOUNDARIES OF A STATE'S ZONE. National Oceanic and Atmospheric Administra-tion, Rockville, Md. Office of Coastal Zone For primary bibliographic entry see Field 6E. W76-03624

TIDAL DATUMS AND MAPPING TIDAL BOUN-

National Ocean Survey, Rockville, Md.
For primary bibliographic entry see Field 6E.
W76-03625

LEGAL ASPECTS OF TIDAL BOUNDARIES OF THE COASTAL ZONE, National Oceanic and Atmospheric Administration, Rockville, Md For primary bibliographic entry see Field 6E. W76-03626

MICROBIAL-MALATHION INTERACTIONS IN ARTIFICIAL SALT-MARSH ECOSYSTEMS: EF-FECT AND DEGRADATION, Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab. For primary bibliographic entry see Field 5B. W76-03634

EPIZOOTIOLOGY OF TUMORS IN A POPULA-TION OF JUVENILE ENGLISH SOLE (PAROPHRYS VETULUS) FROM PUGET SOUND, WASHINGTON, Washington Univ., Seattle. Fisheries Research Inst For primary bibliographic entry see Field 5C. W76-03657

PLANKTONIC ECOSYSTEMS. THE EFFECTS OF DYSTROPHIC CONDITIONS ON STRUC-TURE AND FUNCTION IN THE GULF OF FOS (ECOSYSTEME PLANCTONIQUE. STRUC-TURE ET FONCTIONNEMENT EN RELATION AVEC DES PHENOMENES DE DYSTROPHIE AVEC DES PHENOMENES DE DISINOPI (GOLFE DE FOS)), Centre Universitaire de Luminy, Marse (France). Laboratoire d'Hydrobiologie Marine. For primary bibliographic entry see Field 5C. W76-03658

MAN-MADE EUTROPHICATION IN A NEW-FOUNDLAND (CANADA) HARBOUR. Queens Univ., Kingston (Ontario). Dept. of Biolo-

For primary bibliographic entry see Field 5C.

#### Field 2-WATER CYCLE

#### Group 2L-Estuaries

W76-03659

ON THE POSSIBILITIES OF COASTAL, MID-SHELF, AND SHELF BREAK UPWELLING, Florida State Univ., Tallahassee. Dept. Oceanography. Y. Hsueh, and H-W. Ou.

Journal of Physical Oceanography, Vol 5, No 4, p 670-682, October 1975. 16 fig, 8 ref, 1 append. NSF GX-33502, ONR N0014-67-A-0235-0002.

Descriptors: \*Upwelling, \*Circulation, \*Continental shelf, \*Model studies, Oceans, Ocean circulation, Ocean currents, Winds, Stress, Coasts, Mathematical models, Density, Density stratification, Flow, Boundary layers, Topography. Oceanography.

The steady-state circulation on a continental shelf under the combined influence of a wind stress, a surface density distribution, and a longshore current over the shelf break was investigated in a linear, beta-plane model that allowed a longshore pressure gradient. The problem was quasi-twodimensional and lent itself readily to a standard boundary-layer analysis. For the range of parameters considered, the hydrostatic Lineykin layer allowed a vertical mass transport into the surface Ekman layer to compensate for the one-sided divergence created by the wind stress at the coast and was, therefore, primarily responsible for coastal upwelling. An equatorward longshore current over the shelf break, on the other hand, contributed to a shelf break upwelling. There is, in this case, also a possibility for a poleward undercurrent over the continental shelf. When the equatorward longshore velocity at the shelf break bottom is sufficiently large, however, the poleward undercurrent may not exist at all, and the whole shelf water may move equatorward. The resulting onshore transport in the bottom Ekman layer then causes upward motion, and allows for an appearance of coastal upwelling in the presence of upwelling at the continental shelf break. The interior density anomaly in the model was always diffusive and admitted an upwelling circulation beneath sharp surface contrasts with a shoreward gradient. (Sims-ISWS) W76-03731

#### LATERAL MOMENTUM FLUX IN BOUNDARY

Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 2H. W76-03732

#### THE STRUCTURE AND DYNAMICS OF THE

OCEAN SURFACE MIXED LAYER, National Oceanic and Atmospheric Administra-tion, Princeton, N.J. Geophysical Fluid Dynamics

G. L. Mellor, and P. A. Durbin.

Journal of Physical Oceanography, Vol 5, No 4, p 718-728, October 1975. 15 fig, 26 ref. NOAA 04-3-022-33

Descriptors: \*Model studies, \*Mathematical models, \*Oceans, \*Temperature, Boundary layers, Mixing, Thermocline, Physical properties, Energy budget, Ocean circulation, Oceanography. Identifiers: \*Surface mixed layer.

A one-dimensional unsteady model of the ocean surface mixed layer was described. The Reynolds differential equations for turbulent ocean layers were the starting point; mixing coefficients for mementum and heat were then provided empirically. In the present model all empirical constants were obtained from neutral turbulence data. Numerical calculations were restricted to horizontally homogeneous layers, but stationary and nonstationary flows may be treated. Comparisons of pre-diction and data were favorable. (Sims-ISWS) W76-03733

ON THE GENERATION OF MESOSCALE ED-DIES AND THEIR CONTRIBUTION TO THE OCEANIC GENERAL CIRCULATION. I. A PRELIMINARY NUMERICAL EXPERIMENT, National Oceanic and Atmospheric Administra-tion, Princeton, N.J. Geophysical Fluid Dynamics

Lab W. R. Holland, and L. B. Lin.

Journal of Physical Oceanography, Vol 5, No 4, p 642-657, October 1975. 16 fig, 15 ref, 1 append. NOAA 04-03-022-33.

Descriptors: \*Ocean circulation, \*Model studies, \*Mathematical models, \*Eddies, Flow, Winds, Currents(Water), Ocean currents, Viscosity, Stress, Momentum transfer, Energy transfer, Oceanography.

Identifiers: Baroclinic instability, Mesoscale ed-

Numerical experiments on the wind-driven ocean circulation in a closed basin show that mesoscale eddies can appear spontaneously during the in-tegration of the equations of motion for a baroclinic ocean. For some values of the basic parameters governing the flow, the solutions reach a steady state, while for other values finite-am-plitude eddies remain a part of the final statistically steady state. In the eddying cases the solu-tions can be regarded as a mean flow upon which is superimposed a set of eddies which propagate westward at a few kilometers per day. The eddies typically have horizontal wavelengths of a few undred kilometers. Analyses of the energetics show the eddies to be generated by the process of baroclinic instability. The potential energy of the mean flow is released to supply energy to the ed-dies. The computed Reynolds stresses, while small compared to the terms in the geostrophic balance of the mean momentum equations, do have a strong influence on the mean circulation. If the flow were steady, there would be no flow in the deep layer in this model. The vorticity balance of the mean flow is strongly affected by the presence of mesoscale eddies. In this report, the two-layer model and its numerical formulation was model and its numerical formulation was described. Then the results of a preliminary eddy experiment were discussed in detail, showing the spontaneous growth of baroclinic eddies and describing the final statistical steady state that occurs. (See also W76-03735) (Sims-ISWS) W76-03734

ON THE GENERATION OF MESOSCALE EDDIES AND THEIR CONTRIBUTION TO THE OCEANIC GENERAL CIRCULATION. II. A

PARAMETER STUDY,
National Oceanic and Atmospheric Administration, Princeton, N.J. Geophysical Fluid Dynamics

W. R. Holland, and L. B. Lin. Journal of Physical Oceanography, Vol 5, No 4, p 658-669, October 1975. 15 fig, 2 tab, 13 ref. NOAA

Descriptors: \*Ocean circulation, \*Model studies, \*Mathematical models, \*Eddies, Flow, Winds, Currents(Water), Ocean currents, Viscosity, Stress, Momentum transfer, Energy transfer, Oceanography.
Identifiers: Mesoscale eddies.

In this investigation, the wind- driven ocean circulation theories were extended to include mesoscale eddies as an integral part of the general circulation of the ocean. A two-layer numerical model of ocean circulation in a simple, rectangular basin driven by a steady wind stress was used for this purpose. The equations of motion were integrated as an initial value problem until the solutions reached either a steady state or, in the case of an ocean in which eddies have appeared spontaneously as a result of baroclinic instability, a statistically steady state. Part I of this study discussed the formation of the numerical model and presented results from a preliminary numerical experiment. In this part of the study, results from 10 additional

experiments were examined to understand how eddy generation and the resulting eddy statistics depend upon the basic parameters describing the model ocean. In particular, the dependence of results on the coefficient of lateral viscosity, the wind stress amplitude, the wind stress distribution (one and two gyres), the basin size, and the boundary conditions (slip and no-slip) were discussed. Results showed a wide range of model behavior under the conditions examined, but the common result was that the mean circulation of eddying oceans is importantly altered, even largely determined, by the statistical nature of the eddy field. (See also W76-03734) (Sims-ISWS) W76-03735

OCEANIC VELOCITY GRADIENTS.

Texas A and M Univ., College Station. Dept. of Oceanography. A. D. Kirwan, Jr.

Journal of Physical Oceanography, Vol 5, No 4, p 729-735, October 1975, 3 tab. 16 ref.

Descriptors: \*Model studies, \*Mathematical models, \*Oceans, \*Ocean circulation, Velocity, Circulation, Currents(Water), Flow, Coriolis force, Winds, On-site data collections, Oceanography.
Identifiers: \*Velocity gradients.

A theoretical and experimental investigation of the nature of oceanic velocity gradients was presented. Starting with the equations of motion, equations governing the dynamic behavior of velocity gradients along with a first integral were derived. These 9 equations were partitioned differently than in a previous derivation so as to simplify the physical interpretation. It was pointed out that solutions to the gradient equations overspecify the equations of motion. This lead to the development of compatibility conditions for the solutions. These conditions generalized similar equations used in elasticity. The general gradient equations were applied to two-dimensional horizontal flow. This application demonstrated the role that the wind field and bottom topography can play in generating velocity gradients. Free solutions to the linearized gradient equations were discussed. The solutions showed that inertial gravitational waves can be present in the gradient fields. A summary of observations of velocity gradients was given. Although the observations were made in different locales and by different procedures, the range in values was surprisingly small. These data were also used to evaluate the relative sizes of some of the various terms in the gradient equations. The dominant terms are the ones involving Coriolis while the beta terms are the least significant. The data also suggested that the geostrophic vorticity formula is not a reliable approximation in strong current regimes. (Sims-ISWS) W76-03736

INTERACTION OF SMALL-AMPLITUDE SURFACE GRAVITY WAVES WITH SURFACE

Physical Dynamics, Inc., Berkeley, Calif. J. A. Thomson, and B. J. West.

Journal of Physical Oceanography, Vol 5, No 4, p 736-749, October 1975. 10 fig, 19 ref, 2 append. DARPA F30602-C-0494.

Descriptors: \*Model studies, \*Mathematical models, \*Ocean waves, \*Currents(Water), Gravity waves, Internal waves, Waves(Water), Oceans, Oceanography.
Identifiers: \*Wave patterns, \*Surface slicks, In-

teraction, Surface currents.

The one-dimensional interaction of surface gravity waves with nondispersive internal waves was studied in a linear approximation by solving the equations of motion in a coordinate system moving with the time-independent surface current system induced by the internal wave. A range of surface wavelengths was found which was reflected by the current system (as seen in this coordinate system). In the ocean-fixed frame, these waves were identified as waves which interact strongly with the internal waves and exchange energy with it. The effect on the surface wave pattern and the relation to surface slicks was discussed. (Sims-ISWS) W76-03737

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OBSERVATIONS OF THE DIRECTIONAL SPECTRUM OF OCEAN WAVES USING A CLOVERLEAF BUOY, Research Inst. for Applied Mechanics, Fukuoka

(Japan). H. Mitsuyasu, F. Tasai, T. Suhara, S. Mizuno, and

M. Ohkusu.

Journal of Physical Oceanography, Vol 5, No 4, p 750-760, October 1975. 14 fig, 1 tab, 12 ref, 1 ap-

Descriptors: \*Ocean waves, \*On-site investiga-tions, \*Buoys, Waves(Water), Analytical techniques, Oceans, Bays, Winds, Data collections, Measurement, Data processing, Oceanog-

Identifiers: \*Directional wave spectra, Spectral analysis.

Analysis of the directional spectra of typical sets of surface wave data obtained using a cloverleaf buoy system in the open sea and a bay were reported. It was shown that the directional wave spectrum can be approximated by the product of the frequency spectrum and a unimodal angular distribution with mean direction approximately equal to that of the wind. It was also shown that equal to that of the wind. It was also shown that various forms of frequency spectra exist, even in relatively simple wave systems, depending on their generating conditions. Ocean waves at fairly short dimensionless fetches showed spectral forms with very narrow spectral width, similar to those of laboratory wind waves. On the other hand, the spectral forms for ocean waves at very long dimensionless fetches were quite similar to the Pierson-Moskowitz spectra, which are considered, within our present data, to be the wave spectra with the largest spectral width. Finally, there exist many ocean waves at moderate dimenthere exist many ocean waves at moderate dimensionless fetches, which showed spectral forms with interminate spectral widths lying between the above two extremes. However, a definite relation-ship between the spectral width and the dimen-sionless fetch has not been obtained in the present study. (Sims-ISWS) W76-03738

MESOSCALE VARIABILITY OF SEA SURFACE TEMPERATURES,

Florida State Univ., Tallahassee. Dept. of

Meteorology. C. G. Holladay, and J. J. O'Brien

Journal of Physical Oceanography, Vol 5, No 4, p 761-772, October 1975. 14 fig, 1 tab, 29 ref. NOAA 04-3-022-28, NSF GX-33502.

Descriptors: \*Oceans, \*Temperature, \*Upwelling, \*Oregon, Coasts, Circulation, Ocean circulation, Winds, Fish, Salmon, Water temperature, Sea water, Data collections, Measurement, Data processing, Analytical techniques, Variability, Oceanography.
Identifiers: \*Sea surface temperatures, COHO

Results of an investigation of the nature of the Results of an investigation of the nature of the mesoscale variability of sea surface temperature (SST) in the upwelling zone off the central coast of Oregon were presented. A knowledge of SST mesoscale variability is important toward understanding the mesoscale air-sea interaction process in an upwelling zone. Almost-daily sea surface temperature data gathered by remote sensing techniques provided the basis for this investigation. These data were gathered over a 60-day period during the COHO, Project in summer day period during the COHO Project in summer

1973. In order to study the influence of wind forcing on the mesoscale SST field, wind data were gathered from an anemometer located at Newport, Oregon. Some important results of this investigaoregon. Some important results of this investiga-tion were: (1) the daily SST fields respond rapidly to wind forcing, (2) the three-week mean SST's tend to follow the large-scale bathymetry, and (3) identification of SST eddies from day to day on daily perturbation (from the three-week means) maps is made difficult because of the existence of strong horizontal flow and strong shear in the longshore current. Other important results were revealed by a two-dimensional spectral analysis of the daily horizontal sea surface temperature fields and the perturbation fields. This analysis indicated that a large amount of variance of the sea surface temperature is concentrated in the 16-40 km wavelength range, and over the range of scales from 4-20 km the isotropic part of the temperature variance spectrum obeys a -3 power law. (Sims-W76-03739

EFFECTS OF PULSATING WIND ON VELOCITY PROFILES AND MICROSTRUC-

Delaware Univ., Newark, Coll. of Marine Studies.

Journal of Physical Oceanography, Vol 5, No 4, p 782-789, October 1975. 6 fig, 1 tab, 15 ref. ONR N00014-75-C-0285.

\*Winds, \*Waves(Water). Descriptors: \*\*Laboratory tests, Equipment, Measurement, Instrumentation, Velocity, Variability, Fluctuations, Data processing, Analytical techniques, Oceanog-

Identifiers: \*Pulsating winds, Microstructures, Friction velocities.

Friction velocities of pulsating winds were measured, as well as slope and curvature distributions of the disturbed water surface. The results obtained with the same average wind speed, but with pulsations of various frequencies and amplitudes, were compared. The pulsations were found to be critical on wind and wave structures when the regime of the wind boundary layer is affected. The influence of pulsations becomes secondary, when the wind boundary layer is aerodynamically rough. A distinct feature of this regime, generally occurring in the field, is that more capillaries are produced by pulsating winds. (Sims-ISWS) W76-03741

THE ECOLOGY OF SUBLITTORAL COMMUNITIES AT ABEREIDDY QUARRY, PEMBROKESHIRE,

BRUKESHIRE, University Coll. of North Wales, Bangor. Dept. of Marine Biology. For primary bibliographic entry see Field 5C. W76-03763

THE MACRO-INVERTEBRATE FAUNA OF THE INTERTIDAL SOFT SEDIMENTS OF SOUTH EAST ENGLAND, Institute of Terrestrial Ecology, Norwich (England). Colney Research Station. For primary bibliographic entry see Field 5B. W76-03764

NATURAL FLUCTUATIONS IN A SOFT BOTTOM BENTHIC COMMUNITY, University Coll. of North Wales, Menai Bridge. Marine Science Labs.

For primary bibliographic entry see Field 5C. W76-03765

THE EFFECTS OF TEMPERATURE ON THE DEVELOPMENT AND SURVIVAL OF THE EGGS AND LARVAE OF THE ATLANTIC SILVERSIDE, MENIDIA MENIDIA, New York Ocean Science Lab., Montauk. Dept. of

Fisheries Oceanography.

For primary bibliographic entry see Field 5C.

RELATIVE IMPORTANCE OF FOOD AND WATER IN LONG-TERM ZINC-65 ACCUMULATION OF MARINE BIOTA, International Lab. of Marine Radioactivity, Monte

Carlo (Monaco). Oceanographic Museum. For primary bibliographic entry see Field 5C. W76-03780

IDENTIFICATION AND POTENTIAL BIOLOGICAL EFFECTS OF THE MAJOR COMPONENTS IN THE SEAWATER EXTRACT OF

A BUNKER FUEL, California Univ., Berkeley. School of Public

For primary bibliographic entry see Field 5A. W76-03781

QUANTITATIVE BIOLOGICAL ASSESSMENT OF THE BENTHIC FAUNA IN DEEP BASINS OF THE GULF OF MAINE, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 5B.

W76-03783

REVIEW OF THE MODELS OF TIDAL WATERS.

Monash Univ., Clayton (Australia). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 5B.

THE RIVER THAMES FLOOD DEFENCE BAR-

Great London Council, (England), Dept. of Public Health Engineering. For primary bibliographic entry see Field 4A. W76-03800

DETERMINING ULTIMATE CAPACITY OF THE COASTAL ZONE FOR WASTEWATER AND WASTEWATER RESIDUALS,

Rosenstiel School of Marine and Atmospheric Science, Miami, Fla.
For primary bibliographic entry see Field 5E.
W76-03847

SOME CHARACTERISTICS OF THE BEAUFORT SEA SHELF CURRENT,

Coast Guard Research and Development Center, Groton, Conn. G. L. Hufford.

Journal of the Geophysical Research, Vol 80, No 24, p 3465-3468, August 20, 1975. 5 fig, 7 ref.

Descriptors: \*Currents(Water), \*Ocean currents, \*Ocean circulation, \*Arctic ocean, Continental shelf, Continental slope, Current meters, Winds, On-site investigations, Oceanography. Identifiers: \*Beaufort Sea.

A 15-day current record was obtained from a 25-m depth on the Beaufort Sea Shelf approximately 83 km northeast of Barrow, Alaska, during August 1972. This is one of the longest continuous current records for the shelf area. The current observed at 25 m showed a mean flow to the east but was subject to irregularities and wide day-to-day varia-tions. The local wind, although the major cause of many of the fluctuations, was not the primary driving force of the eastward flow. The eastward motion of the current appeared to be dominated by the momentum present in the flow prior to its entry into the shelf region. There was an intensification of the current during prevailing westerly winds and a suppression of the current during sustained easterly winds. A change in wind direction (to easterly wind) such as occurred from August 13 to 19 was not sufficient to cause current

#### Field 2-WATER CYCLE

#### Group 2L—Estuaries

reversal even though the east wind lasted for more than 6 days. (Sims-ISWS) W76-03853

#### SUSPENDED SOLIDS IN WATER.

Office of Naval Research, Arlington, Va. Ocean Science and Technology Div.

Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, 1974. 320 p. Edited by R. J.

Descriptors: \*Conferences, \*Suspended solids, \*Oceanography, \*Oceans, On-site investigations, Sampling, Instrumentation, Analytical techniques, Measurement, Suspension, On-site tests, Sea water, Sediment transport, Turbidity.

Identifiers: Optical techniques, Scatterance meter, In situ measurements.

Symposium included formal presentation of papers and two half-day workshops. Papers were presented on principles of studying suspended material and its settling velocities, principles of optical techniques, nearshore studies, and offshore studies. The workshops discussions were directed toward the subjects of sampling and concentrating materials, and in situ instrumentation. (See W76-03877 thru W76-03895) (Humphreys-

W76-03876

# PRINCIPLES OF STUDYING SUSPENDED MATERIALS IN WATER, Delaware Univ., Lewes. Coll. of Marine Studies.

In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended, Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 3-15, 1974. 6 fig, 1 tab, 9 ref.

\*Suspended \*Testing procedures, Analytical techniques, Instrumentation, Sampling, Measurement, On-site tests. Suspension. Water analysis. Methodology. Calibrations, Organic matter, Particle size, Parti-

cle shape, Turbidity.
Identifiers: \*Optical techniques, \*In situ measurements, Scatterance meter, Transmissometers, Op-

tical scattering.

The sampling methods for large-volume sampling both at surface and at depth were discussed. The advantages and disadvantages of centrifuging and filtering were covered, along with practical considerations of the various types of molecular fil-ters. Various aspects of light transmission and scattering methods and their instrumentation were evaluated. The importance of and difficulty of adequate calibration was covered briefly. It was concluded that with proper care and planning, suspended solids in water can be accurately studied either by direct sampling or by in situ instrumentation. Studies of suspended solid material have been successfully completed from high-con-centration riverine and estuarine environments to the extremely low concentrations of the deep oceanic environment. (See also W76-03876) (Humphreys-ISWS) W76-03877

STOKES' SETTLING AND CHEMICAL REAC-TIVITY OF SUSPENDED PARTICLES IN NATU-

Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.

A. Lerman, D. Lal, and M. F. Dacey

In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 17-47, 1974. 8 fig, 1 tab, 49 ref.

Descriptors: \*Suspended solids, \*Settling velocity, \*Reviews, Sea water, Lakes, Stokes law, Reynolds number, Stochastic processes, Model studies, Particle shape, Laboratory tests, Chemistry of precipitation, Chemical reactions, Turbidity. entifiers: \*Dissolving particles, Axisymmetrical hodies

Equations were given for the Stokes settling velocities of the following particle shapes: the sphere, oblate spheroid, prolate spheroid, circular cylinder, elliptic cylinder, disc, and hemispherical cap. Dissolution of calcareous and silicate parti-cles settling through ocean water, based on literature data, was analyzed in terms of a model for dissolution rate independent of the particle surface area and a model for dissolution rate dependent on a surface reaction. The settling of dissolving particles in the presence of a countercurrent of upwelling water may lead to formation of thin nepheloid layers. Settling of calcite crystals through a stratified water column was treated as a case of variable nucleation (production) rates, dissolution and agglomeration of crystals en route to the bottom. A stochastic model presented gave a reasonably simple method for treating transient transport of particles in a physically heterogeneous water column. Use of the model requires knowledge of the physical and chemical characteristics of the system, such as the thermal structure of the water column, degree of turbulence, modes of change in particle size, and the structure of input, all of which may vary with the depth thereby affecting the values of transition probabilities that describe transport of a particle through the water column (See also W76-03876) (Humphreys-ISWS) W76-03878

BEAM TRANSMISSOMETERS FOR OCEANO-GRAPHIC MEASUREMENTS.

SKAPHIC MEASUREMENTS,
Scripps Institution of Oceanography, San Diego,
Calif. Visibility Lab.
J. E. Tyler, R. W. Austin, and T. J. Petzold.
In: Suspended Solids in Water; Marine Science,
Volume 4, Proceedings of symposium on
Suspended Solids in Water, Santa Barbara,
California, March 20-22, 1973. Plenum Press, New York, New York, p 51-59, 1974. 5 fig, 12 ref.

Descriptors: \*Instrumentation, \*Oceanography, \*Reviews, \*Suspended solids, Theoretical analysis, Measurement, Water, Sea water, Refractivity, Light, Optical properties, Water properties, Sam-Turbidity.

Identifiers: \*Optical techniques, \*Beam transmissometers, \*Optical measurements, Particle con-

The theoretical basis for the measurement of the beam transmittance of water was reviewed Existing data for the beam transmittance of clean and distilled water were compared to demonstrate the current state of knowledge regarding the beam transmittance of clean water. Several recent instruments of sophisticated design were briefly described and data were given for surface particle concentration. (See also W76-03876) (Humphreys-ISWS)

**VOLUME-SCATTERING** FUNCTIONS OCEAN WATERS.

Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab.
R. C. Smith, R. W. Austin, and T. J. Petzold

In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 61-72, 1974. 3 fig, 1 tab, 20 ref.

\*Suspended \*Instrumentation, \*Sampling, \*Oceanography, Measurement, Particle shape, Particle size, Turbidity, Analysis, Sea water, Refractivity, Optical Identifiers: \*Optical techniques, Volume-scattering function, In situ measurements.

Absolute values of the volume-scattering function, obtained in situ for a variety of natural ocean waters, were presented. The use of optical techniques to infer the concentration, optical characteristics, and size distribution of suspended particulate material in the ocean was outlined. The technique of using single-angle scatter meters to estimate the total volume-scattering function (and hence the suspended particle concentration) was discussed and an optimization of the technique. based upon the data presented, was suggested. The optical signature of the suspended material in a water mass has not yet been fully exploited. To achieve an optimization of information by optical methods one must compare data obtained in the field and in the laboratory using absolutely calibrated instruments, with computer simulated theoretical models of particle characteristics. For information on only the effective projected area concentration of the suspended particles, a singleangle scattering instrument can be used. However, it is impossible to distinguish between a change in the concentration by using the effective projected area and a change in the shape of the size distribution from a single-angle instrument that measures only relative values. (See also W76-03876) (Humphreys-ISWS) W76-03880

#### MIE-THEORY MODELS OF LIGHT SCATTER-ING BY OCEAN PARTICULATES, Miami Univ., Coral Gables, Fla. Dept. of Physics.

H. R. Gordon.

In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 73-86, 1974. 8 fig, 2 tab, 11 ref.

Descriptors: \*Suspended solids, \*Turbidity, \*Sea water, Particle size, Distribution patterns, Refractivity, Analysis, Analytical techniques, Distribu-tion, Mathematical models. On-site data collec-

Identifiers: \*Sargasso Sea, \*Bahama Islands, Mie theory, Volume scattering function, Light scattering.

The general application of Mie theory to the study of the volume-scattering function, VSF, for oceanic particles was discussed in detail. Combination of Coulter counter measurements and the theory was examined in order to enhance understanding of the size-refractive index distributions of the sea water particles. Single-component models (one scattering species) were examined and compared with the Sargasso Sea VSF. These models yielded an average refractive index m relative to water. The meaning of m required the investigation of simple two-component models consisting of low-index organic particles, and highindex inorganics. These models were systematically studied and resulted (for the Sargasso Sea) in the conclusion that the inorganic particles occupy large size ranges while the organic particles are confined to small sizes. Similar studies in the Tongue of the Ocean in the Bahama Islands indicated the necessity of three-component models, which place organic particles in small and large ranges and inorganic particles in midsizes. This model predicts a VSF in good agreement with observation, and indicates that most of the scattering is due to the inorganic particles, with the large-size organic particles (phytoplankton) contributing only at small angles. A simple method for determination of the average refractive index of particles was presented and its limitations were discussed in detail. (See also W76-03876) (Humphreys-ISWS) W76-03881

SPATIAL DISTRIBUTION OF THE INDEX OF REFRACTION OF SUSPENDED MATTER IN THE OCEAN

Oregon State Univ., Corvallis. School of Oceanog-

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J. R. V. Zaneveld.

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In: Suspended Solids in Water; Marine Science, Notine 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 87-100, 1974. 12 fig, 10 ref.

Descriptors: \*Suspended solids, \*Sea water, \*Refractivity, \*Oregon, \*Optical properties, Pacific Ocean, Spatial distributions, On-site in vestigations, Coasts, Oceans, On-site data collections, Analysis, Analytical techniques, Distribu-tion, Particle size, Mathematical studies, Light. Identifiers: \*Galapagos Islands, Particle concen-

The use of the index of refraction of suspended particles as a tracer of water masses and for the analysis of the composition of particulate matter was discussed. A method for determining the index of refraction of suspended particles was presented. In order to determine an index of refraction for a sample, the ratio of light scattered at 45 degrees for two wavelengths and the particle-size distribution must be known. By using a ratio, the difficult problem of determining absolute scattering values was avoided. In order to evaluate the index of refraction as an oceanic paramter, two widely different oceanic areas - the Oregon coastal area and the Equatorial Pacific near the Galapagos Islands - were examined. The spatial distribution of the index of refraction in these areas was studied in relation to ocean dynamics and to the nature of the suspended material. The limitations and advantages of using the index of refraction of suspended particles as an oceanic parameter were presented. The method currently using shows sufficient differentiation between type of particles to be useful in coastal environments. In open-ocean situations the particulate matter is much more uniform and more accurate methods must be developed if the index of refraction is to be used there as an effective tracer. (See also W76-03876) (Humphreys-ISWS) W76-03882

ABSOLUTE CALIBRATION OF A SCAT-TERANCE METER, Texas A and M Univ., College Station. Dept. of

E. S. Fry E.S. Fry.
In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 101-109, 1974. 3 fig. 8 ref.

Descriptors: \*Calibrations, \*Instrumentation, \*Refractivity, \*Suspended solids, Measurement, Sea water, Water, Theoretical analysis, Mathematical studies, Analysis, Analytical techniques, Research equipment, Optical properties, Testing

procedures.
Identifiers: \*Ligh scatterance meter, Volume scattering function, Light scattering.

A new method has been developed for determining the absolute calibration of a light-scattering meter. The method is applicable when the light source is a well-collimated beam of small diamter, such as from a laser. No special reflectance or trans-mittance standards are required and the method is simple to implement. The measured calibration factor includes refractive effects at water/glass/air interfaces as well as the changes in scattering volume with scattering angle. Accuracy in the calibration is determined largely by the signal to canoration is detrimined angery by the signal to noise and the drift in the instrumentation. Due to the spatial coherence of the laser beam, there will be speckle noise superimposed on the calibration functions. When this is a problem, it is easily eliminated by oscillating the screen in its plane with a small amplitude (on the order of 1 mm). (See also W76-03876) (Humphreys-ISWS) W76-03883

EFFECTS OF TROPICAL STORM AGNES ON THE SUSPENDED SOLIDS OF THE NORTHERN CHESAPEAKE BAY, Johns Hopkins Univ., Baltimore, Md. Chesapeake

J. R. Schubel.

J. R. Schubel.
In: Suspended Solids in Water; Marine Science,
Volume 4, Proceedings of symposium on
Suspended Solids in Water, Santa Barbara,
California, March 20-22, 1973. Plenum Press, New
York, New York, p 113-132, 1974. 13 fig, 17 ref. NSF GA-36091.

Descriptors: \*Suspended solids, \*Chesapeake Bay, \*On-site investigations, On-site data collec-\*Chesapeake tions, Salinity, Estuaries, Hurricanes, Hydrologic aspects, Spatial distribution, Flood flow, Stream-flow, Discharge(Water), Sediment discharge. Identifiers: \*Susquehanna River, Tropical storm

During the spring freshet, the Susquehanna River overpowers the characteristic net non-tidal estuarine circulation in the upper 20-30 km of the estuary and the net flow and sediment transport are seaward at all depths. With subsiding river flow, the net non-tidal estuarine circulation is reestablished in the upper reaches of the bay and a established in the appet reaches of the bay and turbidity maximum is formed near the head of the estuary. The passage of tropical storm Agnes in June 1972, resulted in record flooding throughout the drainage basin of the northern Chesapeake Bay. On June 24, the day the Susquehanna crested at its mouth, the instantaneous peak flow exceeded 32,000 cu m/sec. The daily average discharge of 27.750 cu m/sec for that day exceeded discharge of 2.75 cut in specific for that any exceeding the previous daily average high by nearly 33 percent. Throughout the bay, salinities were reduced to levels lower than any previously observed. On June 26, 1972, salinities were less than 0.5% from June 26, 1972, saimittee were less than 0.3% from surface to bottom throughout the upper 60 km of the bay, and the surface salinity was less than 1% in the upper 125 km of the bay. Salinities remained low throughout most of the summer, but had nearly recovered to normal levels by September. On June 24, the concentration of suspended solids at the mouth of the Susquehanna River exceeded 10,000 mg/l and, in a one-week period, the sedi-ment discharge exceeded that of the past several decades. The bulk of this sediment was deposited in the upper 40 km of the bay. (See also W76-03876) (Humphreys-ISWS) W76-03884

DISTRIBUTION AND TRANSPORT OF SUSPENDED PARTICULATE MATTER IN SUB-DISTRIBUTION MARINE CANYONS OFF CALIFORNIA, SOUTHERN

National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.; and National Oceanic and Atmospheric Administration, Miami Fla. Marine Geology and Geophysics Lab. D. E. Drake.

In: Suspended Solids in Water; Marine Science, Nolume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, P. 133-153, 1974. 12 fig, 2 tab, 34 ref. NSF GB-8206 and GA-22842.

Descriptors: \*Suspended solids, \*California, \*Submarine canyons, \*On-site investigations, Oceans, Continental shelf, Sediment transport, Turbidity currents, Sea water, Water temperature, Refractivity, Currents(Water), Sediment distribution, Distribution patterns, Turbidity, Profiles. Identifiers: Nepheloid layers.

Studies of the distribution of suspended particulate matter in submarine canyons off southern California were reported. Simultaneously col-

lected light beam transmission and salini-ty/temperature data demonstrated an association of particule maxima with the relatively steep segments of the vertical, water-density gradient over shelf, slope, and canyon environments. Within the submarine canvons that cut the mainland shelf. mid-water particle maxima contain high percentages of terrigenous detritus supplied by seaward flow from canyon nepheloid layers. The concentrations of particulate matter in the canvon nepheloid layers rarely, if ever, exceed 10 mg/l even in areas close to major rivers; typical peak values in the canyon heads are 3 to 6 mg/l. It was concluded that turbid-layer, density-excess underflows are not possible at these low concentrations. Bottom currents in the Santa Cruz Canyon are vigorous and show a net downcanyon flow that is far too strong to be explained by turbid-layer flow. While submarine canyons off souther California are an important pathway forfine sediment leaving the shelf, it is likely that no more than 10-15% of the annual terrigenous supply moves to deeper water by way of the canyon. (See also W76-03876) (Humphreys-ISWS) W76-03885

LIGHT-SCATTERING EIGHT-SCATTERING
PROFILES AND SUSPENDED MATTER OVER
NITINAT DEEP-SEA FAN,
Washington Univ., Seattle. Dept. of Oceanogrphy.
E. T. Baker, R. W. Sternberg, and D. A.

McManus.

In: Suspended Solids in Water; Marine Science, In: Suspended Solids in water, Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 155-172, 1974. 11 fig, 17 ref.

Descriptors: \*Suspended solids, \*Refractivity, \*Washington, \*Continental slope, Submarine canyons, On-site investigations, On-site data collections, Instrumentation, Sea water, Oceans, Sampling, Turbidity, Particle size, Distribution, Calibrations, Profiles, Sedimentation rates. Identifiers: \*Nitinat Deep Sea Fan, Nephelometer, Nepheloid layer, Light scattering.

During September 1971 and June 1972, a total of 65 light-scattering profiles were continuously recorded in the waters over Nitinat Fan with a nephelometer. All profiles extended from the sea surface to a point 20 m above the sea floor (maximum depth 2400 m) and as many as 5 prominent scattering layers were observed within the water column at a given station. These profiles described an evidently permanent and geographically continuous bottom nepheloid layer (BNL). This layer was thinner than that found in many of the deep-ocean basins, ranging between about 50 and 300 m. Scattering intensities at the base of the BNL correlated well with the varations in thickness, creating a relatively consistent picture in which the thickest and most intense portions of the BNL occupy the topographic lows (the northwestern flank and Cascadia Valley) leaving the levees and bordering marginal ridge covered by only a relatively thin and weak scattering layer. Estimates of the amount of inorganic sediment which was suspended within this layer were made on the basis of 24 samples of particulate matter collected simultaneously in situ with the nephelometer readings. The average value for the mass of inorganic sediment contained in a 1 sq cm column of water within the BNL was about 0.5 mg. To sustain the net sedimentation rate recorded in Nitinat Fan over the last 9000 years, these particles must have a residence time of only about 1 month in the BNL. (See also W76-03876) (Humphreys-ISWS) W76-03886

PHYSICAL, CHEMICAL, AND OPTICAL MEA-SURES OF SUSPENDED-PARTICLE CONCEN-TRATIONS: THEIR INTERCOMPARISONS

#### Field 2-WATER CYCLE

#### Group 2L—Estuaries

AND APPLICATION TO THE WEST AFRICAN SHELF,

University of South Florida, St. Petersburg, Dept.

of Marine Science. K. L. Carder, P. R. Betzer, and D. W. Eggimann. In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 173-193, 1974. 7 fig, 2 tab, 37 ref. ONR N00014-72-0363-0001.

Descriptors: \*Suspended solids, \*Continental shelf, \*Africa, \*Particle size, Properties, \*Atlantic Ocean, Sea water, Oceans, On-site investigations, Sampling, Salinity, Measurement, Instrumenta-Laboratory tests, Physical properties, Densi-

ty, Refractivity, Analysis, Surveys. Identifiers: \*West African shelf, Sierra Leone(Africa), Liberia(Africa), Light scattering,

Nepheloid layers.

A property of oceanic particulate matter referred to as 'apparent density' was calculated by dividing the weight of suspended particular matter (SPM) by the volume of particles. This parameter is equal to 'mass density' for particles, such as minerals, containing little water. Apparent density calculations were made for a series of samples collected on R/V Trident cruise 112 to the continental shelves of Sierra Leone and Liberia. These values ranged from 0.104 to 1.79 for samples with particulate organic carbon fractions (POC/SPM) ranging from 0.486 to 0.037. Cross sections of salinity, light scattering beta (45), suspended particulate matter (SPM), and beta (45)/total surface area for this re-gion of the west African shelf showed a northwestward-flowing bottom current laden with inorganic sediment having a high apparent density and s southeastward-flowing, organic-rich (low apparent density) surface current. Of the measures of partidensity) surface current. On the measures of parti-cle concentration applied to these waters, SPM and beta (45) showed greatest correlation (r=0.960), suggesting that apparent density is highly correlated with the particle index of refrac-tion. Total particulate volume and total particulate surface area data were not nearly as well correlated with either beta (45) or SPM; optical/physical theories were proposed to explain this phenomenon. (See also W76-03876) (Humphreys-ISWS) W76-03887

THE DISTRIBUTION OF PARTICULATE MATTER IN A NORTHWEST AFRICAN COASTAL UPWELLING AREA, Copenhagen Univ., Denmark. Inst. of Physical

Oceanography.

G. Kullenberg. In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 195-202, 1974. 6 fig, 1 tab, 11

Descriptors: \*Suspended solids, \*Coasts, \*Africa, \*Ocean circulation, \*Atlantic ocean, Upwelling, Water, Sea water, Oceans, Salinity, Profiles, Water temperature, Distribution, On-site investigations, Analysis, On-site data collections, Tracking techniques, Topography, Biology, Chemistry, Surveys. Identifiers: Light scattering.

The particle distribution in the upper 200 m of the upwelling area oceanward of the northwest Arican coast has been investigated, using an in-situ integrating light-scattering meter, with the two-fold purpose of relating to the general conditions in the area regarding circulation, topography, biology, and chemistry, and investigating the possibility of defining and tracing water masses in such an area by their particle content. It was shown that the particle distribution in an upwelling area can serve as an indicator of physical and other processes and that the particle content is a very distinct characteristic of a water mass. Of special interest was the inversion layer of high particle content found beneath the upwelling water. The high particle load of the bottom water on the slope indicated the presence of an eroding current. (See also W76-03876) (Humphreys-ISWS)

THE SUSPENDED MATERIAL OF THE AMAZON SHELF AND TROPICAL ATLANTIC OCEAN,

Delaware Univ., Lewes. Coll. of Marine Studies R I Gibbs

In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 203-210, 1974. 6 fig, 3 ref. ONR N00014-67-A-0356-0011.

Descriptors: \*Suspended solids, \*Atlantic Ocean, \*Tropical regions, \*Continental shelf, \*South America, Sediment transport, Distribution, Distribution patterns, Sea water, Sampling, Analysis, Turbidity, On-site investigations, Refractivity,

Identifiers: \*Amazon shelf.

Filtered samples and optical data from six cruises in the Atlantic Ocean off the Amazon River between 1963 and 1971 were used to determine transport of surface suspended material outward into the ocean. During high-river discharge the turbid-water line (equal to or greater than 2.0 mg/l) extends 100 km seaward from the river mouth and northwestward along the coast for about 2000 km in a zone averaging 60 km wide. During low-river discharge, a similar pattern extends seaward only 80 km from the river mouth and northwestward for about 2000 km. This turbid zone migrates between these extreme limits at intermediate stages of river discharge. The surface concentration of suspended material exhibits a steady seaward decrease and the zone along the outer continental shelf shows lobes of turbid water being engulfed by the northwestward flowing Guiana current. (See also W76-03876) (Humphreys-ISWS) W76-03889

TURBIDITY DISTRIBUTION IN THE DEEP WATERS OF THE WESTERN ATLANTIC TROUGH.

Lamont-Doherty Geological

Palisades, N.Y.

S. L. Eittreim, and M. Ewing.

In: Suspended Solids in Water; Marine Science, In: Suspended Solus in Water, Marine Science, Volume 4, Proceedings of symposium on Suspeneded Solids, in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, Per 213-225, 1974. 4 fig. 19 ref. ONR N-00014-67-0108-0004, NSF GA27281.

Descriptors: \*Suspended solids, \*Turbidity, \*Atlantic Ocean, \*Distribution patterns, Submarine canyons, On-site investigations, Instrementation, Measurement, Sampling, Deep water, Analysis, Surveys. Identifiers: \*Atlantic trough, Nepheloid layer.

The 'background' turbidity (clearest water of the water column) was mapped in the western Atlantic using standardized nephelometer measurements taken on R/V Conrad cruises 15 and 16. This background was utilized as a reference turbidity to map features of the bottom-water turbidity using older unstandardized relative nephelometer profiles. Variations in background turbidity by a factor of 3 apparently reflect the pattern of biologfactor of 3 apparently reflect the pattern of biological productivity in the overlying surface waters: high background in an equatorial belt and in latitudes greater than the subtropical convergences, but low background in the temperature latitudes. The resulting distributions of near-bottom turbidity values showed a maximum in the southwestern Argentine Basin and a lesser maximum along the continental rise of the North imum along the continental rise of the North

American Basin. Bottom turbidity in the nepheloid layer decreases from both basins toward the equator and appears to be both a function of bottom current velocity and proximity to terrigenous sediment sources. (See also W76-03876) (Humphreys-W76-03890

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VARIATIONS IN BENTHIC BOUNDARY LAYER PHENOMENA: NEPHELOID LAYER IN THE NORTH AMERICAN BASIN, Geological

Observatory

Palisades, N.Y.

Lamont-Doherty

P. E. Biscaye, and S. L. Eittreim.
In: Suspended Solids in Water; Marine Science. Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 227-260, 1974. 16 fig, 4 tab, 24 ref. ONR N00014-67-A-0108-0004, NSF GA27281, ERDA AT(11-1)3132.

Descriptors: \*Suspended solids, \*Turbidity, Atlantic Ocean, \*Distribution patterns, Surveys, On-site investigations, Sea water, Oceans, Sampling, Profiles, Water temperature, Boundary layers, Instrumentation, Measurement, Analysis, layers, Instrumentation, Measurement, Analysis, Testing procedures, Currents(Water), Density cur-rents, Salinity, Refractivity. Identifiers: \*Blake-Bahama Outer Ridge, \*Hatteras Abyssal Plain, \*North American Basin, Excess-radon, Nepheloid layer.

Observations of phenomena associated with a benthic boundary layer were made over a 19-day period in two different regimes in the western North American Basin. Repeated measurements of temperature, in situ and in vitro turbidity, suspended particulate concentrations and excess radon versus depth, as well as bottom photo-graphs, were made as a function of time at two locations on the lower slope of the Blake-Bahama Outer Ridge (BBOR) and at one location on the Hatteras Abyssal Plain (HAP). At the BBOR sites the benthic boundary layer was manifest by high concentrations of suspended particulates, high tur-bidity, and intense vertical mixing indicated by excess radon. Vertical distributions of particulate matter and radon were related to the thermal structure of the water mass, and the strongest manifestations of frictional interaction between the water and bottom were seen below 150-300 m. At the HAP site, manifestations of the benthic boundary layer were less intense, less variable and restricted to a thinner layer. Turbidity and concentration of particulate matter were much lower than on the BBOR and vertical mixing measured by excess radon was an order of magnitude lower. Depth profiles of these parameters showed the strongest evidence of the benthic boundary layer to be restricted to 80-100 m above the bottom. An hypothesis to explain the variations observed on the BBOR was presented in which eddies of Antarctic Bottom Water are injected into the more turbid, rapidly southward flowing Western Boundary Undercurrent north of the study area. (See also W76-03876) (Humphreys-ISWS) W76-03891

DISTRIBUTION OF SUSPENDED PARTICLES IN THE EQUATORIAL PACIFIC OCEAN Oregon State Univ., Corvallis. School of Oceanography

In: Suspended Solids in Water; Marine Science, In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, P. 261-270, 1974. 6 fig, 24 ref. ONR N00014-67-A-0369-0007.

Descriptors: \*Suspended solids, \*Pacific Ocean, \*Spatial distribution, Particle size, Oceans, Sea water, Water temperature, Dissolved oxygen, Analysis, On-site data collections, Refractivity,

Identifiers: \*Panama Basin, Light scattering.

Light scattering, size distribution of the suspended particles and standard hydrographic parameters were measured on water samples collected at 152 were measured on water samples collected at 152 stations in the Panama Basin during October and November 1971. The particle-volume concentrations were calculated by fitting the measured particle size distributions to the exponential distribution and integrating the exponential distribution. Total suspended matter was calculated using a particle density of 2.2 mg/ml. The suspended matter in the water below 25 m depth ranges from 0.04 mg/l to 0.092 mg/l and from 0.11 to 1.76 mg/l in the sea surface. The spatial distribution of the suspended matter appears to be closely related to the dynamic matter appears to be closely related to the dynamic conditions of the water: the equatorial front, in-teraction of the Cromwell Current and the Galapagos Islands, and interaction of bottom current against the Carnegie Ridge. (See also W76-03876) (Humphreys-ISWS)

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#### SUSPENDED MATTER AND THE STABILITY OF THE WATER COLUMN: CENTRAL CARIB-

BEAN SEA,
Texas A and M Univ., College Station. Dept. of Oceanography. N. J. Bassin.

In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 271-279, 1974. 4 fig, 20 ref. ONR N00014-68-A-0308-0002.

Descriptors: \*Suspended solids, \*Sea water, \*Spatial distribution, On-site data collections, Onsite investigations, Oceans, Analysis, Analytical techniques, Salinity, Water temperature, Stability. Identifiers: \*Caribbean Sea, Total suspended matter, Nepheloid layer, Water column.

Total suspended matter, TSM, was measured in the water column at 4 stations in the central Caribbean Sea in relationship to the vertical profile of static stability. It was postulated that the several TSM maxima at depth are associated with zones of low turbulence, and the near-bottom nepheloid layer observed in many areas of the world ocean is a function of a near-bottom density increase coupled with a bottom shear capable of suspending fine sediment. The absence of one or both of these criteria explains the reported lack of a nepheloid layer in the Caribbean. Future work should conlayer in the Cambbean. Future work should con-sider continuous vertical profiling by means of in-situ STD records and nephelometry in order to ex-amine the small-scale effect of stability on suspended particulates and to rigorously quantify their relationships. (See also W76-03876) their relationships. (See also (Humphreys-ISWS) W76-03893

#### LIGHT-SCATTERING MEASUREMENTS AND CHEMICAL ANALYSIS OF SUSPENDED MATTER IN THE NEAR-BOTTOM NEPHELOID LAYER OF THE GULF OF MEXICO, Texas A and M Univ., College Station. Dept. of

Oceanography.
R. A. Feely, L. Sullivan, and W. M. Sackett.

In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, p 281-293, 1974. 7 fig. 1 tab, 27 ref. ONR N00014-68-A-0308-0002, ONR N00014-67-0108-0004, NSF GA-27281.

Descriptors: \*Suspended solids, \*Gulf of Mexico, \*Surveys, On-site investigations, On-site data col-lections, Sea water, Oceans, Profiles, Sampling, Retubles, Sea water, Oceans, Trothes, January, Analytical techniques, Analysis, Instrumentation, Testing procedures, Distribution, Chemical analysis, Aluminum, Iron, Organic matter, Carbon. Identifiers: \*Caribbean Sea, \*Nepheloid layer, Light scattering, Silicone.

The mass and chemical composition of suspended material in three near-bottom profiles in the Gulf of Mexico and in one profile in the Caribbean showed a definite relationship to light scattering as measured by an Ewing-Thorndike nephelometer. For the Gulf of Mexico profiles, an increase in light scattering from about 300-700 m above the bottom indicated a near-bottom nepheloid layer. In this layer, at about 100-200 m above the bottom the concentrations of particulate aluminum, silicon, iron and organic carbon generally increased from 2 to 6 times over their respective concentrations at mid-depth. Constant and low light-scattering values and suspended matter concentrations at one station indicated that no near-bottom nepheloid layer was found in the Yucatan Basin of the Caribbean. (See also W76-03876) (Humphreys-W76-03894

# LIGHT SCATTERING AND SUSPENDED PARTICULATE MATTER ON A TRANSECT OF THE ATLANTIC OCEAN AT 11 DEG N,

University of South Florida, St. Petersburg. Dept.

of Marine Science.
P. R. Betzer, K. L. Carder, and D. W. Eggimann.
In: Suspended Solids in Water; Marine Science, Volume 4, Proceedings of symposium on Suspended Solids in Water, Santa Barbara, California, March 20-22, 1973, Plenum Press, New York, New York, p 295-314, 1974. 7 fig, 2 tab, 34 ref. ONR N00014-72-A-0363-0001.

Descriptors: \*Suspended solids, \*Atlantic Ocean, \*Surveys, On-site investigations, On-site data collections, Sampling, Sea water, Water temperature, Chemical properties, Physical properties, Testing procedures, Analytical techniques, Distribution, Profiles, Organic matter, Carbonates. Identifiers: \*Nepheloid layer, Light scattering.

A combined investigation of the optical, physical and chemical properties was carried out on the suspended particulate matter on a transect of the North Atlantic Ocean at about 11 deg N. A nepheloid layer approximately 100 m thick was found at near-bottom in the western basin of the North Atlantic; no evidence of a near-bottom nepheloid layer was found in the eastern basin. Increases in suspended particulate matter and absolute light scattering occurred between 3000 and 4000 m at 2 stations near South America. At 2 stations over the Mid-Atlantic Ridge, large (30-40%) increases in the mass suspended particulate matter occurred 30 m above the bottom. Particulate organic carbon and particulate carbonate determinations indicated these increases are due to greater amounts of refractory oxides and/or hydroxide in the suspended matter and may represent an injection or diffusion of materials from the ridge to deep ocean waters. Samples taken in Subtropic Underwater, oxygen minimum water and Antarctic Intermediate Water showed relatively low amounts of suspended particulate matter and ab-solute light scattering, indicating that the nephe-loid character reported for these water masses in the northwestern Caribbean and Yucatan Channel must be acquired in transit through the Caribbean Sea. Near-bottom nepheloid layers were found at four stations along a 240 km stretch of the African continental rise. (See also (Humphreys-ISWS) W76-03895 W76-03876)

#### WATER QUALITY IN RHODE RIVER AT SMITHSONIAN INSTITUTION PIER NEAR AN-NAPOLIS, MARYLAND, THROUGH DECEMBER 1973, APRIL

Geological Survey, Edgewater, Md. Chesapeake Bay Center.

For primary bibliographic entry see Field 5A.

#### 3. WATER SUPPLY AUGMENTATION AND CONSERVATION

#### 3A. Saline Water Conversion

PROCESS AND INSTALLATION FOR THE TREATMENT OF WATER AND OTHER

LIQUIDS,
Abwassertechnik und Kunst stoffbau GmbH, Waiblingen (East Germany). (Assignee).

H. Wess. U S Patent No 3,920,544, 7 p, 1 fig, 14 ref; Official Gazette of the United States Patent Office, Voi 940, No 3, p 1368, November 18, 1975.

Descriptors: \*Patents, \*Desalination, \*Demineralization, \*Water purification, \*Water reatment, \*Ion exchange, Resins, Separation techniques, Desalination processes, Desalination

Identifiers: Resinous-bed ion exchanger.

A process and installation for the treatment, parwater, aqueous solutions, acids and the like, is described in which the liquid being treated is conducted in resinous-bed ion exchanger. The liquid is conducted at a vertical motion component from above downward into the inflow end, and with a vertical motion component from the bottom upwardly out of the outflow end of the resinous-bed ion exchanger. The charges during the liquid treat-ment are removed from the bed at its outflow end and re-entrained at its inflow end. Due to the cyclic withdrawal of charges of the ion exchanger resin at the outflow end at an upward directed outflow, there is achieved the required loosening of the ion exchanger bed for the undisturbed opera-tion of the process and the possibility of continual withdrawal of pure water during the partial regeneration of the resin. Electronic control devices may be largely dispensed with, since for the particular needs it is sufficient to employ relathe particular needs it is sufficient to employ relatively simple measuring apparatus for functional control. Each time the lengthiest loaded ion exchanger charge is withdrawn from the bed and regenerated. This periodically regenerated exchanger charge is then re-entrained in the bed at the water inflow side, so that the inflowing water constantly flows through a fully exchangeable ion exchanger. The filtering up from below affords a 100% utilization of the total ion exchanger bed while avoiding danger of denosit strand formations. while avoiding danger of deposit strand formations on the bed. (Sinha-OEIS) W76-03515

# WATER DISTILLATION IN THE TURKMEN SSR AND THE UZBEK SSR, (IN RUSSIAN), Desert Inst., Ashkhabad (USSR).

M. V. Kolodin. Probl Osvoeniya Pstyn', 4, 65-70, 1974.

\*Pilot plants, Descriptors: \*Distillation, \*Pilot plant \*Industrial plants, Desalination. Identifiers: Turkmen-SSR, \*USSR, Uzbek-SSR.

A chronological description is presented of research on water distillation and erection of pilot and industrial distilling installations in both USSR republics.—Copyright 1975, Biological Abstracts, W76-03697

# RELATIVE TRANSPORT RATES OF ALAKLI ION ACROSS CELLULOSE ACETATE MEM-

ION ACROSS
BRANES,
California Univ., Los Angeles. School of Engineering and Applied Science.
W. G. Sunu, and D. N. Bennion.

W. G. Sunu, and D. N. Bennion.

Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-249 193, \$5.00 in paper copy, \$2.25 in microfiche. California

#### Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

#### Group 3A—Saline Water Conversion

Water Resources Center, Desalination Report No 61, UCLAcENG-7543, June 1975. 87 p, 14 fig, 12 tab, 50 ref, append.

Descriptors: \*Desalination, \*Ion transport, Membrane, \*Membrane processes, \*Alkalis(Bases), Cations, Ions, Ion exchange. Identifiers: Cellulose acetate membranes

The salt transport parameter Le, the water transport parameter Lo, and the cation transference number t to the +m power in asymmetric cellulose acetate membranes cured at 77C, 85C, and 93C have been measured for alkali chloride solutions. The relative effective transport mobilities, defined by the product of the transport parameter Le with by the product of the transport parameter Lee With the transference number t to the +m power have the following trends K+>Rb+>Cs+>Na+> Li+ loose membrane (77C), K+>Rb+>Cs+>Na+>Li+ medium membrane (85C), Rb+>K+>Cs+>Na+>Li+ tight membrane (93C). The sequences observed for loose and medium membranes are explained by a thermostatic model. For a tight membrane the ribidium ion becomes the most mobile. This sequence shift is explained by an interpretation which indicates that the relative an interpretation which indicates that the relative transport rates of ions are controlled by the ion-site interactions and by the hydration energies of ions in the solution phase and in the membrane phase. (Snyder-Calif, Davis) W76-03960

RECLAMATION OF HYPERION SECONDARY EFFLUENT BY REVERSE OSMOSIS,

California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 5D.
W76-03961

#### 3B. Water Yield Improvement

CONTROLLING EVAPORATION OF WATER, Nalco Chemical Co., Chicago, Ill. (Assignee). I F Vartiak

US Patent No 3,918,904, 2 p, 5 ref; Official Gazette of the United States Patent Office, Vol 940, No 2, p 839, November 11, 1975.

Descriptors: \*Patents, \*Evaporation control, \*Chemcontrol, Bodies of water, Water conservation. Polymers.

Identifiers: Evaporation rates, Water-soluble vinyl addition polymers

Evaporation of water is retarded at a predetermined rate by the addition of a water-soluble vinyl addition polymer to a body of water. The polymer is in a water dissolved state since in that form it is easily dispersed throughout the water system and it is in the form of acrylamide sodium acrylate copolymer. (Sinha-OEIS) W76-03506

SNOWMELT RUNOFF EFFICIENCIES ON ARIZONA WATERSHEDS,

Forest Service (USDA), Silver City, N. Mex. Gila National Forest. R. M. Solomon, P. F. Ffolliott, M. B. Baker, G. J.

Gottfried, Jr., and J. R. Thompson.

Arizona University Agriculture Experiment Station, (Tucson), Research Report 274, 50 p, 1975. 1

Descriptors: \*Watersheds(Basins), \*Snowmelt, \*Runoff, \*Arizona, Water yield, Snowpacks, Precipitation(Atmospheric), Equations, Regression analysis, Watershed management, Water yield improvement.

This report documents snowmelt runoff efficiencies for several experimental watersheds in different vegetation zones throughout those parts of Arizona where snowmelt water yield is a significant contributor to the annual water yield budget.

Tentative regression equations were developed relating snowpack runoff efficiencies to inventory-predicting variables. Timing of precipitation throughout the snowpack accumulation-melt period is of importance in establishing the snowmelt runoff efficiency value. (Witt-IPC) W76-03581

MECHANIZATION OF WATER-RAISING FROM THE WATER-ACCUMULATING WELLS 'CHIRLE', (IN RUSSIAN), Akademiya Nauk Turkmenskoi SSR, Ashkhabad.

Research Inst. of Agriculture. For primary bibliographic entry see Field 4B. W76-03663

DETERMINING THE POWER LEVEL AND RANGE OF SOLAR WATER-RAISING INSTALLATIONS IN THE TURKMEN SSR, (IN RUS-

For primary bibliographic entry see Field 3F. W76-03664

WATER AVAILABILITY FOR IN-STREAM FLOWS: SNAKE RIVER, SWAN FALLS-HELLS CANYON DAM.

Idaho Water Resource Board, Boise For primary bibliographic entry see Field 4A.

THE FUTURE OF WATER RESOURCES IN

NORTHEASTERN ILLINOIS, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 6D.

THE CONSTRUCTION AND OPERATION OF GRAVEL WELL SOURCES WITH PARTICULAR REFERENCE TO THOSE OF THE NENE AND OUSE WATER BOARD, H. B. Wilson

Journal of the Institution of Water Engineers and Scientists, Vol 29, No 3, p 123-128, May, 1975. 4 fig, 2 tab, 7 ref.

Descriptors: "Water supply, "Wells, "Water management(Applied), (Water treatment, Rivers, Construction costs, Odor, Water quality, Filtration, Aquifers, Groundwater.
Identifiers: Gravel wells, Great Britain.

As part of water resources management planning in Great Britain, the potential use of gravel well sources for water supply has been investigated. With an increasing water demand and the length of time and/or costs of cleaning up rivers, gravel wells may be a useful source for small water supplies. Problems connected with sites and well construction in the Nene and Ouse Water Board area were discussed. It was found that the yield of gravel well sources varies in Great Britain from 0.1 to 5.0 mgd depending upon the extent and depth of gravel deposits (which are dependent on the size of river flowing through them). The possibility of combining gravel and river water may be used to give a total required quantity. The quality of water obtained from gravel wells was generally good, with no taste or odor problems. Water quality deterioration may occur when sites are flooded; this may be overcome by a single stage of filtra-tion. Also, abstraction can continue at times when other aquifers would be over pumped. (Kramer-FIRL) W76-03817

THE ECONOMICS OF GEOTHERMAL RESOURCES IN THE IMPERIAL VALLEY: A PRELIMINARY ANALYSIS, California Univ., Riverside. Graduate School of

Administration.
For primary bibliographic entry see Field 3E.

HYDROLOGIC RELATIONS UNDISTURBED AND CONVERTED BIG SAGEBRUSH LANDS: THE STATUS OF OUR KNOWLEDGE,
Forest Service (USDA), Laramie, Wyo. Forest
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For primary bibliographic entry see Field 2A. W76-03967

#### 3C. Use Of Water Of Impaired Quality

WASTEWATER USE IN THE PRODUCTION OF FOOD AND FIBER--PROCEEDINGS.
Robert S. Kerr Water Research Center, Ada,

For primary bibliographic entry see Field 5D. W76-03541

REVIEW OF AMERICAN PUBLIC WORKS AS-SOCIATION STUDY OF FACILITIES UTILIZ-ING LAND APPLICATION OF WASTEWATER, American Public Works Association, Chicago, Ill. For primary bibliographic entry see Field 5D. W76-03542

WASTEWATER UTILIZATION TEGRATED AQUACULTURE AND AGRICUL-TURE SYSTEMS,

Agricultural Research Organization, Dor (Israel). Fish and Aquaculture Station. For primary bibliographic entry see Field 5D. W76-03543

MORBIDITY RISK FACTORS FROM SPRAY IRRIGATION WITH TREATED WASTE WASTE WATERS.

Texas Univ., Houston. School of Public Health. For primary bibliographic entry see Field 5C. W76-03546

PERMISSIBLE LEVELS OF HEAVY METALS PERMISSIBLE LEVELS OF HEAVY METALS
IN SECONDARY EFFLUENT FOR USE IN A
COMBINED SEWAGE TREATMENT-MARINE
AQUACULTURE SYSTEM. I. MONITORING
DURING PILOT OPERATION,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 5C.
W76-03547

PERMISSIBLE LEVELS OF HEAVY METALS PERMISSIBLE LEVELS OF HEAVI METALS
IN SECONDARY EFFLUENT FOR USE IN A
COMBINED SEWAGE TREATMENT-MARINE
AQUACULTURE SYSTEM. II. DEVELOPMENT
OF GUIDELINES BY METHOD OF ADDI-

Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 5C. W76-03548

REPORT ON PILOT AQUACULTURE SYSTEM USING DOMESTIC WASTEWATERS FOR REARING PACIFIC SALMON SMOLTS, Humboldt State Univ., Arcata, Calif. School of Natural Resources. For primary bibliographic entry see Field 5C. W76-03553

AN EXPERIMENT IN THE EUTROPHICATION OF TERRESTRIAL ECOSYSTEMS WITH SEWAGE: EVIDENCE OF NITRIFICATION IN A LATE SUCCESSIONAL FOREST, Brookhaven National Lab., Upton, N.Y. For primary bibliographic entry see Field 5C. W76-03555

IRRIGATION WITH WASTEWATER BAKERSFIELD, CALIFORNIA, AT Metcalf and Eddy, Inc., Palo Alto, Calif.

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#### WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

#### Conservation In Industry—Group 3E

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R. W. Crites. In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 229-239. 1 fig, 10 ref, 4 tab.

Descriptors: \*Irrigation, \*Crops, \*Sewage effluents, California, Barley, Alfalfa, Cont/Field), Cotton, Pastures, Forages, Waste water disposal, Water pollution control, History, Operations, En water pollution to the riskoty, Operations, Environmental effects, Irrigation practices, Soil properties, Water pollution sources, Groundwater, Nitrates, Irrigation effects, Fertilizers. Identifiers: Bakersfield(Calif), San Joaquin Vallentifiers: Bakersfield(Calif), San Joaquin Vallentifiers:

Waste water from the city's effluent treatment plant has been used to irrigate cropland in the southern end of the San Joaquin Valley in California for more than 60 years. This paper documents the principal features of this successful operation by tracing its historical development, current operation, and environmental effects. Irrigation and agricultural practices are discussed individually for alfalfa, barley, corn, cotton, and pasture grass. Crop yields vary from slightly below (cotton) to well above (corn) the county-wide average. These yields are greatly affected by the soil characteristics as well as the effluent characteristics. A claim that the irrigation operation is contaminating the groundwater with nitrates has not been substantiated. (See also W76-03541) (Witt-IPC) W76-03556

#### USE OF CATTLE FEEDLOT RUNOFF IN CROP

USE OF CATTLE FEEDLOT RUNOFF IN CROP PRODUCTION,
Kansas State Univ., Manhattan.
G. W. Wallingford, L. S. Murphy, W. L. Powers,
H. L. Manges, and L. A. Schmid.
In: Wastewater Use in the Production of Food and Fiber - Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 273-294. 11 fig, 10 ref, 3 tab.

Descriptors: \*Feed lots, Runoff, \*Crop production, 'Irrigation water, Corn(Field), Plant growth, Soil chemical properties, Kansas, Salts, Ammonium salts, Sodium compounds, Potassium compounds, Electrical conductance, Nitrates, Nitrogen, Nitrogen compounds, Phosphorus compounds, Nutrients, Water pollution control, Water pollution sources, \*Farm wastes, Disposal, Waste disposal, Irrigation, Lagoons, Effluents, Waste water disposal, Agricultural runoff. Descriptors: \*Feed lots, Runoff, \*Crop produc-

The effects of irrigation with beef cattle feedlot-lagoon water on the growth and composition of com (Zea mays) forage and on chemical properties of a Kansas soil were investigated. The lagoon water contains large amounts of salts, particularly monovalent cations (ammonium, potassium, and monovaent canons (ammonum, potassum, and sodium). Continued applications of lagoon water increased the salt content of the soil. Increases in the electrical conductivity of the soil were linearly related to the amount of lagoon water applied. The heaviest lagoon-water applied. Ine baviest lagoon-water treatments contributed more salts than could be utilized by corn plants or leached into the lower portions of the soil profile. Wittate-nitrogen accumulated in the soil from the 2 and 37 cm/year lagoon water applications reflecting the relatively high nitrogen content of agoon water. Phosphorus also accumulated with lagoon water applications but accumulations were methy restricted to the surface 20 cm reflecting. mostly restricted to the surface 20 cm, reflecting lack of movement of phosphorus in the soil. Maximum yields of corn forage occurred at an average application rate of 13 cm/year after the second and epurcation rate of 13 cm/year after the second and bird year and at 22 cm/year after the fourth year. At higher rates, yields declined. Maximum ramoval rates of applied nutrients were achieved at the same application rates that produced maximum yields. (See also W76-03541) (Witt-IPC) W76-03559

RRIGATION OF TREES AND CROPS WITH SEWAGE STABILIZATION POND EFFLUENT NSOUTHERN MICHIGAN,

Williams and Works, Grand Rapids, Mich.

For primary bibliographic entry see Field 5C. W76-03560

LEGAL CONSTRAINTS ON THE USE OF WASTEWATER FOR FOOD AND FIBER, Virginia Polytechnic Inst. and State Un Blackburg. Water Resources Research Center. For primary bibliographic entry see Field 6E. W76-03562

SOCIAL, POLITICAL, REGULATORY AND MARKETING PROBLEMS OF MARINE WASTE-FOOD RECYCLING SYSTEMS, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 6B. W76-03563

THE MICHIGAN STATE UNIVERSITY WATER QUALITY MANAGEMENT PROGRAM, Michigan State Univ., East Lansing, Inst. of Water Research.

For primary bibliographic entry see Field 5D.

MINERAL QUALITY OF FISH POND EF-FLUENT RELATED TO SOIL PROPERTIES AND CROP PRODUCTION,

Arkansas Univ., Fayetteville. L. H. Hileman.

In: Wastewater Use in the Production of Food and Fiber--Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 412-416. 2 tab.

Descriptors: Fish hatcheries, \*Effluents, \*Mineralogy, \*Crop production, \*Irrigation water, \*Soil properties, Calcium compounds, Bicarbonates, Magnesium compounds, Sodium compounds, Salts, Dissolved solids, Catfishes, Plant growth, Water pollution sources, Water pollution control, Waste disposal, Water quality, Soil chemical properties, Soil physical properties, Soil disposal fields, Nutrients.

Irrigation water quality is determined by the kind and amount of mineral elements present in the water, and the relationship of these elements to the soil's chemical and physical properties as they affect both immediate and future crop production. Data are presented showing the calcium, magnesi-um, sodium, bicarbonate, total dissolved salt, sodium adsorption ratio, and soluble sodium persoluble soluble soluble as percent of the total soluble cations, Ca, Mg, Na, K) in catfish pond waste water, and their potential effects on the soluble and plant growth are discussed. Indescriminate use of these waters can result in the alteration of plant nutrient uptake, therby altering plant quality, reducing crop yields, and changing soil physical and chemical properties. Farmers planning to use catfish waste water for irrigation should obtain a chemical analysis and irrigation quality evaluation before applying it to soils. (See also W76-03541) (Witt-IPC) W76-03569

CRITICAL VARIABLES IN FOOD-ITEM POPULATION DYNAMICS IN A WASTE-WATER AQUACULTURE SYSTEM,

Virginia Polytechnic Inst. and State Univ., Blacksburg.

In: Wastewater Use in the Production of Food and Fiber-roceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 497-503. 3 fig, 5 ref, 2 tab.

\*Aquiculture. Descriptors: Amphipoda, \*Sewage effluents, Food chains, Simulation analysis, Water pollution control, Water pollution treatment, Salinity, Water properties, Sea water, Growth rate, Animal growth, Temperature, Economics, California, Time lag, Fish food organisms, Fish, Smolt, Aquatic

Identifiers: Humboldt Bay(Calif), Oncorhynchus kisutch, Anisogammarus confervicolus.

An aquaculture system fertilized by domestic sewage was constructed adjacent to Humboldt Bay, California, for use in rearing salmon (Oncorhynchus kisutch) to the smolt age, i.e., the age at which they migrate to the ocean. A simulation model showed that the lag time needed for attaining an adequate food source (in this case the gammarid amphipod, Anisogammarus confervico-lus) can be reduced by first controlling the system variables (salinity) to promote rapid growth of the amphipods, and then converting the variables to levels optimal for the salmon. Salinity should initially be kept at 24 parts per thousand to maximize amphipod growth rate, and then lowered (by decreasing the proportion of seawater) to meet the physiological needs of the salmon. Temperature would affect growth rate as well, but temperature control is not economically feasible. (See also W76-03541) (Witt-IPC) W76-03572

STANDING CROPS OF BENTHIC FAUNA IN MARINE AQUACULTURE PONDS USING RECLAIMED WATER,
Humboldt State Univ., Arcata, Calif.

For primary bibliographic entry see Field 5C. W76-03574

TRITIUM FRACTIONATION IN PLANTS,

Environmental Monitoring and Support Lab., Las Vegas, Nev. Monitoring Systems Research and Development Div.
For primary bibliographic entry see Field 5A. W76-03632

INFLUENCE OF TREATED MUNICIPAL WASTE WATER ON GROWTH, FIBER, ACID-SOLUBLE NUCLEOTIDES, PROTEIN, AND AMINO ACID CONTENT IN WHEAT GRAIN, Arizona Univ., Tucson. Dept. of Agronomy and Plant Genetics

For primary bibliographic entry see Field 5E. W76-03690

DETACHMENT OF SOIL AGGREGATES BY SIMULATED RAINFALL FROM HEAVILY MANURED SOILS IN EASTERN NEBRASKA, Nebraska Univ., Lincoln. Dept. of Agronomy. For primary bibliographic entry see Field 2J. W76-03730

NEEDED: A GROUND-WATER TREATY BETWEEN THE UNITED STATES AND MEX-

For primary bibliographic entry see Field 4B. W76-03918

#### 3E. Conservation In Industry

WASTEWATER USE IN THE PRODUCTION OF FOOD AND FIBER--PROCEEDINGS.
Robert S. Kerr Water Research Center, Ada,

For primary bibliographic entry see Field 5D. W76-03541

REUSE OF WATER IN THE PULP AND PAPER INDUSTRY

Australian Paper Manufacturers Ltd., Melbourne (Australia).

Appita (Journal of the Australian and New Zealand Pulp and Paper Industry Technical Association), Vol 29, No 1, p 36-40, July, 1975. 3 fig.

Descriptors: Pulp and paper industry, \*Australia, \*Water reuse, Water conservation, Water pollu-

#### Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

#### Group 3E—Conservation In Industry

tion control, Economics, Equipment, Water treatment, Recycling, Water, Pollution abatement, Foreign countries, \*Pulp wastes, Industrial

The principal reasons for water reuse (i.e., resource scarcity, environmental constraints, and economic factors) are examined. Water reuse practices are described and the equipment and practices are described and the equipment and processes utilized to prepare the water for various recycling processes are shown to vary with quality and environmental requirements. Examples of water reuse systems utilized by Australian Paper Manufacturers Ltd. mills are included, and some of the problems associated with water reuse are discussed. The future of water reuse in the paper industry is considered. (Sykes-IPC) W76-03578

REPORT ON WATER FOR ENERGY IN THE UPPER COLORADO RIVER BASIN.

Bureau of Reclamation, Denver, Colo. Water for Energy Management Team. For primary bibliographic entry see Field 6D

W76-03727

GEOTHERMAL LEASING PROGRAM, VOLS. II AND III-LEASING OF GEOTHERMAL RESOURCES IN THREE CALIFORNIA AREAS (FINAL ENVIRONMENTAL IMPACT STATE-

Department of the Interior, Washington, D.C. For primary bibliographic entry see Field 4B. W76-03925

**ECONOMICS** OF GEOTHERMAL RESOURCES IN THE IMPERIAL VALLEY: A

PRELIMINARY ANALYSIS, California Univ., Riverside. Graduate School of

Administration.

H. J. Vaux, Jr., and B. Nakayama.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-249 182, tion service, springifield, va 22161 as FB-249 182, \$4.00 in paper copy, \$2.25 in microfiche. California Water Resources Center, Contribution No 153, November 1975. 34 p, 1 fig, 6 tab, 83 ref. (California Water Resources Center Project UCAL-WRC-W-344).

Descriptors: \*Geothermal studies, \*Geothermal powerplants, \*Electric power production, \*Economic feasibility, Resource development, Model studies, Resources, Natural resources, Regulation, \*California, Water supply, Capital

Identifiers: \*Imperial Valley(California).

A model based on the calculus of variations permits a preliminary assessment of the attractive-ness of geothermal resources. If technological problems of handling water dominated geothermal system can be overcome, and if exploitation entails no major social costs in the form of land subsidence, increased seismicity and residuals generation, then it is likely that the resource could become an attractive source of power. The economic feasibility of power production will be particularly sensitive to the price of power, the cost of capital and the willingness of exploiter firms to bear risk. Without substantial changes in the conditions of supply and demand for water in the lower Colorado Basin, the geothermal fields are unlikely to be an attractive source of additional water supplies. Production of power from a Imperial geothermal resources will be crucially influenced by governmental regulation. The current practice of applying regulatory policies for oil and gas to geothermal development is inappropriate.
More flexible regulatory strategies that account
for uncertainties about the nature of the resource as well as social cost uncertainties are called for. Such strategies should be amenable to revision as more experience with the resource is gained. (Snyder-Calif, Davis) W76\_03959

APPLICATION OF REVERSE OSMOSIS IN WATER CONSERVATION AND TREATMENT IN THE MOTOR INDUSTRY, Ames Crosta Mills and Co., Heywood (England).

For primary bibliographic entry see Field 5D. W76-03992

#### 3F. Conservation In Agriculture

IRRIGATION SYSTEM.

D. L. Bradshaw.
US Patent No 3,918,264, 6 p, 7 fig, 7 ref; Official
Gazette of the United States Patent Office, Vol 940, No 2, p 631, November 11, 1975.

Descriptors: \*Patents, \*Irrigation, \*Irrigation systems, \*Surface irrigation, Furrow irrigation, Distribution systems, Irrigation efficiency, Water control, Flow control, Ditches.

A control system in an irrigation system controls the flow of water from a main irrigation ditch to a branch field ditch. A first control device is placed in the main ditch beyond the branch ditch in the direction of flow of the water and a second control device is placed in the branch ditch. The water flowing in the main ditch is diverted by the first control device in the main ditch, which is normally closed, through the second control device in the main branch ditch, which is normally open, and into the branch ditch, until some time as timer means in the first control device opens the first control device and the second control device is subsequently closed. The control devices are conduits placed centrally in the ditch in the direction of flow of water. A seal is secured to the interior surface of the conduit and extends around it. A valve is mounted in the conduit for axial and pivotal movement. A timer is fixed to activate the valves. (Sinha-OEIS)

ADJUSTABLE FULL SPRAY NOZZLE AND CHANGES REQUIRED ON IMPULSE SPRIN-KLERS TO ACCOMMODATE USE OF NOZ-ZLE, C. L. Best

US Patent No 3,918,642, 3 p, 12 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 940, No 2, p 754, November 11, 1975.

Descriptors: \*Patents. \*Irrigation. \*Sprinkler ir-Descriptors: Faterns, Ingatton, Fractices, Irrigation, Frigation practices, Irrigation systems, Irrigation efficiency, Water conservation, Water distribution(Applied), Application equipment.

A rotary water sprinkler device driven by the impact of the water jet issuing from a nozzle on a hammer has means to vary the elevation, with respect to the horizontal axis, of the issuing water jet so as to vary the range of area sprinkled. This is accomplished by an adjustable nozzle inserted perpendicularly into the discharging end portion of a water supply pipe. The hammer is provided with extensions that will receive the impact of the water issuing from the nozzle. The nozzle can be adjusted by means of a tool so as to emit a stream either parallel to the ground, 25 deg from the horizontal axis or between. This allows the use of more than one sprinkler at a time on one line, even if the areas to be watered are of differen size. Also it permits the issuing of very low water streams which resist breezes better than the streams issuing from conventional sprinklers. A further advantage is that water is saved since the stream of water can be better controlled according to the needs of the areas to be sprinkled. (Sinha-OEIS)

IMPACT AND REACTANT STEP-BY-STEP RO-TARY SPRINKLER HEAD, Nelson (L.R.) Corp., Peoria, Ill. (Assignee).

W. R. Malcolm.

US Patent No 3,918,643, 5 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 940, No 2, p 755, November 11, 1975. De

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Descriptors: \*Patents, \*Irrigation, \*Sprinkler irrigation, Irrigation practices, Irrigation efficiency, Water distribution(Applied), Water conservation, Application equipment.

A reversible part-circle step-by-step rotary sprin-kler head can achieve a favorable distribution pattern. This investion provides a sprinkler head which has a reactant element on the sprinkler body which is operable to deflect the water laterally only when the water is being obstructed by the spoon of the impulse arm in which the torque applied to the sprinkler body by the reactant force applied to the reactant surface is substantially reduced without a corresponding lessening of the effectiveness of maintaining the deflected water in angular alignment with the direction unobstructed flow. This objective is obtained by moving the reactant element radially inward into a radial position intermediate the inner and outer reactant surfaces of the impulse arm spoon. Torque reduction is achieved since the reactant force is applied to the reactant element through a much smaller lever arm. The reactant surface need not be as large in area since it is contacted by the water much nearer the outlet at an earlier time before the flow has had an opportunity to break up. Thus, not only is the applied torque reduced by the reduction in surface area but the time of application is more nearly simultaneous with the application of the impact force. (Sinha-OEIS) W76-03504

IRRIGATION SYSTEMS BY TRICKLING,

J. Leal-Diaz, and J. Rangel-Garza U S Patent No 3,918,646, 3 p, 12 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 940, No 2, p 756, November 11, 1975.

Descriptors: \*Patents, \*Irrigation, \*Irrigation systems, \*Sprinkler irrigation, Irrigation efficiency, Distribution systems, Water control, Application equipment, Irrigation operation and Identifiers: \*Trickle irrigation.

A system for trickle irrigation, sprinkling and the like provides simple, practical and efficient means for self cleaning and a regularity in the discharge flow of the emitters, independent to a certain dregree of the pressure and fluidity which at a given moment may exist in the irrigation water. A two piece water emitter is adapted for mounting primarily inside a hollow conduction line with a confining wall with a outlet port member positioned near the exterior surface of the conduction line for discharge of water. An entrance port is positioned inside the line and comprises in combination: a stiff male member having the outlet as the head for discharging fluid, a fitting for eng ing the wall of the conduction line to hold the member in place with the head substantially flush with the confining wall and with a stiff stem portion defining a water conveyance duct for extend-ing inside the hollow line to convey fluids through the confining wall; and an elastic generally cylindrical female section for fitting snugly around a portion of the stem to form a wall portion of the fluid conveying duct and extend substantially radially into the line. The fluid entrance and exist ports extend from opposite ends of the femal member. (Sinha-OEIS) W76-03505

DRIP IRRIGATION TAP AND SYSTEM,

AG International, Houston, Tex. (Assignee).
J. K. Hoff, R. H. Garrett, M. J. Pastusek, and J. B. Goss

U S Patent No 3,920,037, 4 p, 8 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 940, No 3, p 1209, November 18, 1975.

#### WATER QUANTITY MANAGEMENT AND CONTROL-Field 4 Control Of Water On The Surface—Group 4A

Descriptors: \*Patents, \*Irrigation, \*Surface irriga-Descriptors. Teaches, Irrigation, Surface Irriga-tion, Irrigation systems, Irrigation practices, Ir-rigation efficiency, Applications equipment, Pipes, Tubes. Identifiers: "Drip irrigation.

The tap and drip irrigation system, when used with a drip irrigation device, provides an efficient means of applying fluid to crops, orchards. The inmeans of applying fluid to crops, orchards. The invention includes pipe and a tap which is used in conjunction with the pipe. The tap includes a cylindrical sleeve for surrounding a pertion of the pipe, straps and loops for securing the sleeve to the pipe, a male stinger and a cannula located within the male stinger and extending through the sleeve and pipe to serve as a passageway for fluid from the pipe. The cannula is inserted into the pipe without prior drilling or punching of the pipe. The without prior drilling or punching of the pipe. The cannula does not produce a plug which falls into the pipe and is carried downstream, nor does it produce a core which will plug the cannula. (Sinha-OEIS) W76-03514

DETERMINING THE POWER LEVEL AND RANGE OF SOLAR WATER-RAISING INSTALLATIONS IN THE TURKMEN SSR, (IN RUS-

SIAN), B. V. Tarnizhevskii, and S. Khandovletov. Probl Osvoeniya Pustyn'. 4. 88-91. Illus. 1974.

Descriptors: Mapping, \*Water sources, \*Livestock, Powerplants, Water supply. Identifiers: Turkmen-SSR, \*USSR, \*Solar waterraising installations.

For the 1st time mapping was accomplished of the range territories of Turkmen (USSR) with regard to the available capacity of solar water-raising installations for livestock. For most of the territory the power of installations is 80, 100 and 150 W.--Copyright 1975, Biological Abstracts, Inc. W76-03664

WATER AVAILABILITY FOR IN-STREAM FLOWS: SNAKE RIVER, SWAN FALLS-HELLS CANYON DAM.

Idaho Water Resource Board, Boise. For primary bibliographic entry see Field 4A. W76-03722

APPENDIX 15, IRRIGATION, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office.

1975. 111 p, 32 fig, 53 tab, 10 ref.

Descriptors: "Great Lakes Region, "Irrigation, "Irrigated land, "Illinois, "Indiana, "Michigan, "Minnesota, "New York, "Ohio, "Pennsylvania, "Wisconsin, Water requirements, Irrigable land, Data collections, Water supply, Water sources, Groundwater, Surface waters, Soils, Soil groups, Crops, Vegetable crops, Field crops, Fuit crops, Beans, Potatoes, Sugar beets, Land classification.

This appendix identifies and evaluates the require-Ins appendix identities and evaluates the requirements and potentials of present and future irrigation in the Great Lakes Basin. Included are an inventory of present irrigation, future needs, soil limitations, and a review of other irrigation reports. Basin irrigation was evaluated as to irrigated crops, amount of water used, source of water, and present trends in irrigation. These were used to estimate future irrigation needs and potential for development. Basin soils were studied in order to development. determine potential for irrigation, and availability of groundwater. Well yield data for surficial deposits were used to determine where plentiful supplies of groundwater exist, and to indicate the most favorable areas for irrigation. Previous irrigation reports on segments of the Basin were received. reviewed. Data and projections from these reports were presented for comparison with the inventory

and projections reported. Irrigation occurs on approximately 221,000 acres or 1% of Basin cropland, particularly those acres in high-value vegetables and fruits. Vegetables, including potatoes, account for 60% of the acreage. Corn potatoes, account for 60% of the acreage. Corn (for grain), fruits, and sod each constitute approxi-mately 10% of all irrigated acreage. The remainder includes dry beans, sugar beets, and miscellaneous uses. Irrigation in the four planning subareas around Lake Michigan equals 70% of all Basin ir-rigation. (Humphreys-ISWS) W76-03868

EFFECT OF SOIL AND WATER CONDITIONS ON THE RURAL LANDSCAPE AROUND WOUW, NORTH BRABANT, (IN DUTCH), M. F. Van Oosten.

Versl Landbouwkd Onderz (Agric Res Rep), 833, 1-156. Illus, 1975.

Descriptors: \*Loam, Sands, Soils, Agriculture, \*Land reclamation, Farm management, \*Land use, Grasslands, Rural areas. Identifiers: Landscape, \*Netherlands.

The loamy san region around the village Wouw (Netherlands) is completely dominated by agricultural conditions. The characteristic geology, soil conditions and hydrology of this region are described and their influence on reclamation for farming and the development of agriculture. A suitability rating for arable and for grassland proved that present land use depends on the natural factors.—Copyright 1975, Biological Abstracts, Inc.

SOME PROBLEMS OF LARGE IRRIGATION CHANNEL CONSTRUCTION IN DESERT CON-DITIONS, (IN RUSSIAN), For primary bibliographic entry see Field 4A. W76-03972

# 4. WATER QUANTITY MANAGEMENT AND

#### 4A. Control Of Water On The Surface

THE HARVESTING OF ALGAE AS A FOOD SOURCE FROM WASTEWATER USING NATURAL AND INDUCED FLOCCULATION TECHNIQUES, Louisville Univ., Ky.
For primary bibliographic entry see Field 5D.

W76-03571

A SUGGESTED STATE FOREST PRACTICES ACT (MECHANISM FOR IMPROVING WATER QUALITY ON FOREST LANDS), Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G. W76-03587

'IT'S OUR WATER'--CAN WYOMING CON-STITUTIONALLY PROHIBIT THE EXPORTA-TION OF STATE WATERS, Wyoming Univ., Laramie. Water Resources

Research Inst.
For primary bibliographic entry see Field 6E.
W76-03589

ORDINANCE AMENDING THE COMPREHENSIVE ZONING ORDINANCE NO. 3011 (FOR FLOOD HAZARD PROTECTION, FORT WORTH, TEXAS).

Fort Worth, Tex.
For primary bibliographic entry see Field 6F.

W76-03599

INDIANA DUNES NATIONAL LAKESHORE (S

For primary bibliographic entry see Field 6E. W76-03600

PLANNING ASSISTANCE TO STATES (TO AID IN PREPARATION OF COMPREHENSIVE PLANS FOR WATER AND RELATED RESOURCES).
Corps of Engineers, Washington, D.C. For primary bibliographic entry see Field 6B. W76-03605

FLOOD HAZARD PATTERNS OF URBAN DEVELOPMENT IN THE UPPER MIDWEST, Western Illinois Univ., Macomb. Public Policy

Western Illinois Univ., Maccana.
Research Inst.
D. Singer, and N. Walzer.
Army Corps of Engineers, Rock Island, Illinois,
January 1975. 146 p., 36 tab, 4 append, 194 ref.
DACW-25-75-C-0010.

Descriptors: \*Flood damage, \*Population, \*Forecasting, \*Flood plains, Flood protection, Fu-ture planning(Projected), Research priorities, Land use, Cities, Growth rates, \*Methodology,

Illinois(II), Minnesota(Mn), Missouri(Mo), Wisconsin(Wi)

This study develops a methodology for forecasting flood damage. Social and economic similarity was found between 72 urban areas located in flood found between 72 urban areas located in flood plains and 67 areas not subject to flood, located in 5 states (IA, IL, MN, MI, WI). Relationships between economic characteristics and population were studied. Measures of potential flood damage and actual protection were compared with data on damages. The presence or absence of a flood plain is a valid dichitomization of urban areas, and the is a valid dichitomization of urban areas, and the relationship between actual or potential flood damage and urban characteristics is dominated by the scale effect of total population. Per capita flood damage is sensitive to population growth rate, income and industrial composition. Population size can be used to forecast damages. Projections were obtained for years 2000 and 2020. Though there is great diversity in population changes, on the average, growth will be less rapid in areas subject to flood, though the opposite was true in the past. Today it appears that flood danger or protection will have little impact on growth. It was found, however, that urban areas located in flood plains show a positive correlation between was tound, nowever, that urban areas located in flood plains show a positive correlation between income levels and population increases, though not in non-flood areas. The relationship between population and annual flood damage was estimated for 2 years using multiple regression. A range of estimates was made for various growth rates. Substantial variability is present, not at-tributable to population level, and therefore results are viewed as tentative. (Smith-North Carolina) W76-03627

OKANAGAN WATER DECISIONS, Simon Fraser Univ. Burnaby (British Columbia). Dept. of Geography. For primary bibliographic entry see Field 5G. W76-0356.

WATER AVAILABILITY FOR IN-STREAM FLOWS: SNAKE RIVER, SWAN FALLS-HELLS

CANYON DAM.
Idaho Water Resource Board, Boise.
April 1974. 55 p, 2 fig, 9 tab, 2 ref, 2 append.

Descriptors: \*Water resources, \*Streamflow, \*Comprehensive planning, \*Idaho, Hydrology,

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#### Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4A-Control Of Water On The Surface

Hydrologic budget, Irrigation efficiency, Irrigation, Groundwater, Water demand, Water requirements, Flow augmentation, Hydrologic systems, Simulation analysis, Computer models, Recreation, Flow rates, Rivers.

Identifiers: \*Snake River(Idaho), \*River management. Flow deficits. Flow objectives

This study was designed to provide input to the Pacific Northwest River Basins Commission Comprehensive Joint Plan and the Idaho State Water Plan. Potential conflicts between future streamflow depletion and in-stream uses were identified. Recommended minimum flows for boating, fishing, water quality, and aquatic life were used as planning objectives in evaluating uses of the waters of the Snake River system. River flows were computed as monthly runoff volumes throughout the 1928-1968 period. Hydrologic studies were based on present and future (year 2020) conditions, assuming no restrictions on future development from water supply. A computer simulation of the Snake River reservoirs, diversions, and river flows under prescribed management was used for hydrologic evaluations. The study concluded that present condition flows do not meet demands 100% of the time and that groundwater and increased irrigation efficiency would be part of future solutions. (Terstriep-W76-03722

FLOOD HAZARDS ALONG THE BALCONES ESCARPMENT IN CENTRAL TEXAS--ALTER-NATIVE APPROACHES TO THEIR RECOGNI-TION, MAPPING, AND MANAGEMENT, Texas Univ. at Austin. Dept. of Geological

Sciences

University of Texas, Bureau of Economic Geology, Geological Circular 75-5, 1975. 20 p, 12 fig, 2 tab, 105 ref.

Descriptors: \*Flood plain zoning, \*Flood plain insurance, \*Flood profiles, \*Rainfall-runoff relationships, \*Geomorphology, \*Texas, Flood ways, Flood control, Land use, Hydrology, Hydraulics, Geologic formations, Meanders, Management,

Planning, Mapping.
Identifiers: \*Flood hazard mapping, Flood plain management, Flood risk, Balcones Escarp-ment(Tex), Flood plain regulation, Soils method, Botanic method, Geologic method.

A number of alternatives to flood hazard mapping were examined, including the detailed hydraulic-hydrologic methods, the soils identification method, botanic analysis, and geologic examination. The costs of these methods were shown to vary widely, and the trade-offs were examined. Present day planning tools such as local flood risk reports, flood-plain regulation, flood insurance, flood control, and land use planning, were also discussed. It was shown that, to be effective, flood hazard information must reach local government and serve as the basis for land use regulation. (Terstriep-ISWS) W76-03723

REPORT ON WATER FOR ENERGY IN THE UPPER COLORADO RIVER BASIN.

Bureau of Reclamation, Denver, Colo. Water for Energy Management Team. For primary bibliographic entry see Field 6D.

OUTPUT FROM A CASCADE OF DISCRETE

LINEAR RESERVOIRS WITH STOCHASTIC Department of Environment, Ottawa (Ontario).

Hydrology Research Div. For primary bibliographic entry see Field 2E.

W76-03742

W76-03727

UNSTEADY UNCONFINED FLOW INTO A SURFACE RESERVOIR, Birmingham Univ. (England). Dept. of Civil En-

gineering. ary bibliographic entry see Field 2F. W76-03744

LIMESTONE DRAINAGE SYSTEMS.

Birmingham Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2F. W76-03747

USE OF SATELLITE DATA IN URBAN HYDROLOGIC MODELS, Maryland Univ., College Park. Dept. of Civil En-

gineering. For primary bibliographic entry see Field 7B. W76-03748

STORMFLOWS AND EROSION AFTER TREE-LENGTH SKIDDING ON COASTAL PLAIN SOILS,

Forest Service (USDA), Oxford, Miss. Southern Forest Experiment Station.

For primary bibliographic entry see Field 4C. W76-03756

BULL RUN SAFE YIELD STUDY.

D. Beyerlein.

Hydrocomp Simulation Network Newsletter, Vol 7, No 3, p 1-4, April 1, 1975. 3 fig, 3 tab.

Descriptors: \*Water supply, \*Model studies, \*Mathematical models, Reservoirs, Water demand, Water resources, Water management(Applied), Administration, Watershed management

Identifiers: Bull Run watershed(Ore)

An assessment of the probable yield of the Bull Run Watershed reservoir system was performed for the Bureau of Water Works of the City of Portland, Oregon. The concept of expected yield was evaluated with a probabilistic approach. Many flow traces were generated, each with the same statistical properties as the observed sequences and its own specific storage requirement. The large number of traces used made it possible to compute the probability that a given storage would be adequate to meet a specific demand. Three de-mand sequences for the period 1970 to 2020 were tested. Eight alternative combinations of reservoirs and reservoir modifications were identified. The combinations provided a range of total active storage from 45,350 to 126,450 acre-feet. The storage probability curves generated allowed the Bureau to determine what reservoir storage is The Bureau can also decide the maximum economic storage capacity of the Bull Run reservoir system and then calculate the costs and benefits of seeking additional water customers. (Orr-FIRL) W76-03792

THE RIVER THAMES FLOOD DEFENCE BAR-

Great London Council, (England), Dept. of Public Health Engineering.

R. W. Horner. The Public Health Engineer, Vol 17, p 120-124, September, 1975. 5 fig, 4 ref, 1 append.

Descriptors: \*Flood control, \*Flood protection, Cost analysis, Statistical methods, Estuaries, Tides, Wind tides, Floodgates, Flood routing, Navigation, Water supply, Water storage, Water quality, Hydraulic gates. Identifiers: \*Defense barrier, Thames Estuary,

London(England), Statistical analysis, High tides.

Statistical analysis performed on high and low water levels of the Thames Estuary near London

indicated that the probability of bank full conditions and serious flooding has increased considerably. Cost analysis of the effects of flooding on the area showed that an improvement of the standard defense was needed. Various schemes and the one actually selected are considered. The and the one actually selected are considered. The area considered has a high population, a con-siderable amount of industry with high capital in-vestment and numerous public facilities, indicat-ing that a major flood could have a large impact for years to come. High tides can be caused by a number of factors, such as low air pressure, or depression, wind stress on the water surface and normal gravitational pull of the sun and moon, and if these factors occur together for a long period of time, flooding can occur. Alternative solutions to the traditional methods of flood control fell into three main categories: attenuation of the inflowing tide by a structure that could par-tially close the Estuary; complete closure of the Estuary; and reduction of water levels by overspilling the excess water into low lying marshes. The most feasible was found to be a structure capable of either complete or partial closure of the Estuary. Investigations were undertaken to choose a suitable site and design. Navigational openings were provided and the gates could be closed in 15 minutes, using hydraulic cylinders. Studies showed that other benefits of this structure could be derived, such as improvement of water quality, water storage for water supply, power generation, navigation and amenity and recreation uses. (Pinto-FIRL) W76-03800

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APPENDIX 2, SURFACE WATER HYDROLOGY, GREAT LAKES BASIN FRAMEWORK STUDY.

Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 2E. W76-03862

APPENDIX 11, LEVELS AND FLOWS, GREAT LAKES BASIN FRAMEWORK STUDY.
Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. 1975. 206 p, 75 fig, 71 tab, 70 ref.

Descriptors: \*Great Lakes, \*Water levels, \*Hydrology, \*Hydraulics, \*Regulated flow, \*United States, \*Lake Erie, \*Lake Huron, \*Lake "United States, "Lake Eric, "Lake Huron, "Lake Michigan, "Lake Ontario, "Lake Superior, "St. Lawrence River, Geomorphology, Watersheds(Basins), Data collections, Lakes, Lake basins, Lake shores, Hydrologic data, Precipitation(Atmospheric), Hydrologic aspects, Evaporation, Diversion, Management, Planning, Model studies, Research and development, Navigations Navigation. Identifiers: Problems and needs

This appendix described the factors which affect Great Lakes water levels and outflows. It discussed the physiography, hydraulics, and hydrology of the Great Lakes-St. Lawrence River system; diversions into, out of, and within the system; and lake regulation. In the discussion of regulation, the effects of lake level fluctuation on the various interests within the Basin were developed. Considered in detail were problems related to the various artificial factors which affect lake levels and outflows. These artificial factors include diversions, connecting channel changes, increased consumptive loss of water, and extension of the navigation season on the Great Lakes. The latter will require detailed hydraulic studies and close operational surveillance of connecting channels. The relationships of many of the factors which affect the fluctuation of the lake levels are not completely understood. This situation could be improved by an active physical research program extending the engineering studies currently in progress for the International Joint Commission's study. Precipitation on the Great Lakes and on their tributary land areas is the source of all the

#### WATER QUANTITY MANAGEMENT AND CONTROL-Field 4

Control Of Water On The Surface—Group 4A

water entering the Lakes. On the average, more than half of this water is removed from the Lakes by evaporation. Variations of these two factors are largely responsible for the long-term water level fluctuations. Further investigation of these factors is essential for more effective management of lake levels. (Humphreys-ISWS)

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APPENDIX 14, FLOOD PLAINS, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. 1975. 327 p, 65 fig, 118 tab, 134 ref.

Descriptors: \*Great Lakes Region, \*Flood plains, \*Lake basins, \*Watersheds(Basins), \*United States, \*Lake Erie, \*Lake Huron, \*Lake Superior, Floods, River basins, Flood damage, Flood protection, Data collections, Geomorphology, Flooding, Cities, Land development, Land use, Land classification.

Identifiers: \*Flood problems, Flood plain develop-

This appendix consists of an assessment of the Basin's flood plains and associated present and future problems. Associated drainage problems are presented in Appendix 16, Drainage. Shoreline flooding problems, which are not considered in this appendix, are included in Appendix 12, Shore ins appendix, are included in Appendix 12, shore Use and Erosion. Most damaging floods in the Basin have occurred in the late winter or early spring as a result of rain and snowmelt on frozen or nearly saturated ground. Ice jams at the mouths of the rivers emptying into the major lakes often aggravate the flood situation. Intense summer storms have also created destructive floods, but storms have also created destructive floods, but these are ordinarily confined to local areas. Despite gains in flood control measures during the past three decades, major flooding problems are increasing in urban and highly developed agricultural areas throughout the Basin. Much of the damage and personal tragedy caused by Tropical Storm Agnes, the most expensive and destructive natural disaster in the country's recorded history, which hit the Middle Atlantic States in June 1972, was a direct result of expanding development on which hit the Middle Atlantic States in June 1972, was a direct result of expanding development on vulnerable flood plains. Flood damage reduction may be accomplished through control of rivers or use of flood plains. Stron efforts must be made to limit flood plain development. Where significant encroachment has already occurred, levees, dams, and other man-made devices may be used. Neither without in itself hose the total answer to floor and other man-made devices may be used. Notiner method in itself has the total answer to flood damage reduction, but both must be proportioned to reduce the economic and physical hardships in-flicted by flood waters. (Humphreys-ISWS) W76-03867

APPENDIX 16, DRAINAGE, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. 1975. 97 p, 35 fig, 47 tab.

Descriptors: \*Great Lakes Region, \*Drainage, \*Drainage effects, \*Drainage systems, \*Soil classification, \*Soil groups, \*Soil investigations, \*Soil missiture, \*Soil properties, \*Soil surveys, \*Costbenefit analysis, Subsurface drainage, Soil-waterplant relationships, Urban drainage, Urbanization, Agriculture, Agricultural watersheds, Data collections

Identifiers: \*Agricultural drainage, drainage.

Drainage problems caused by excess water in the soil profile that limits the use of the land for both sou profile that limits the use of the land for both agricultural and urban pruposes were examined in this appendix. Agricultural problems were defined by catagorizing soils into five conditions varying from 'adequate drainage and flood control' to 'combined flood and drainage problems.' The soil categories were used to determine the relative drainage problems in each county. The same type of soil classification was used to identify problem areas in existing and potential urban areas. Drainage needs for the future were projected, and alternative programs along with their land cost and impact were presented. It was concluded that about 12 million of the 32 million acres of agricultural lands in the Great Land. Basis how for tural lands in the Great Lakes Basin have drainage problems. (Terstriep-ISWS) W76-03869

REGIONAL SKEW IN SEARCH OF A PARENT, Geological Survey, Reston, Va. For primary bibliographic entry see Field 2E. W76-03899

RAINFALL-RUNOFF RELATION FOR REDWOOD CREEK ABOVE ORICK, CALIFOR-Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 2A. W76-03903

STATISTICAL SUMMARIES OF STREAM-FLOW RECORDS, OKLAHOMA, THROUGH

Geological Survey, Oklahoma City, Okla. For primary bibliographic entry see Field 7C. W76-03904

HYDROLOGY OF MALHEUR LAKE, HARNEY COUNTY, SOUTHEASTERN OREGON, Geological Survey, Portland, Oreg.

L. L. Hubbard. Available from the National Technical Informa-tion Service, Springfield, Va 22161, as PB-246 717, \$4.00 in paper copy, \$2.25 in microfiche. Water-Resources Investigations 21-75, August 1975. 40 p, 12 fig, 10 tab, 12 ref. L. L. Hubbard.

Descriptors: \*Hydrologic data, \*Lakes, \*Oregon, \*Hydrologic budget, \*Hydrologic equation, Inflow, Discharge(Water), Water levels, Surfaceroundwater relationships, Water storage, Evapotranspiration, Precipitation, (Atmospheric), Water quality, Chemical analysis. Identifiers: \*Malheur Lake(Oreg), \*Harney Country Countr

The various components of inflow and outflow to and from Malheur Lake in Harney County, Oregon, and their relative magnitudes are identified. In 1972 water year the total inflow to the lake was 200,000 acre-ft, but it was only 75,000 acre-ft in 1973 water year. In 1972 water year the Donner und Blitzen River contributed 55 percent of the inflow, with Silvies River, direct precipitation, and Sodhouse Spring contributing 28, 13, and 4 percent respectively. In 1973 the Donner und Blitzen River contributed 61 percent of the inflow. The Silvies River, direct precipitation, and Sod-Blitzen River contributed 61 percent of the inflow. The Silvies River, direct precipitation, and Sodhouse Spring contributed 1, 25, and 12 percent respectively. Groundwater inflow, other than Sodhouse Spring, was negligible. In 1972 water year, 81 percent of the outflow was by evapotranspiration and 19 percent was surface outflow through The Narrows. In 1973, 96 percent of the outflow was by evapotranspiration and 4 percent was surface outflow through The Narrows. Groundwater outflow was negligible. (Woodard-USGS) W76-03906

WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1975. Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 7C. W76-03907

HYDROLOGIC UNIT MAP--1974, STATE OF

Geological Survey, Reston, Va. For primary bibliographic entry see Field 7C. W76-03909 HYDROLOGIC UNIT MAP--1974, STATE OF CALIFORNIA.

Geological Survey, Reston, Va. For primary bibliographic entry see Field 7C. W76-03910

DRAINAGE AREAS FOR ILLINOIS STREAMS, Geological Survey, Champaign, Ill. For primary bibliographic entry see Field 7C. W76-03913

WATER RIGHTS LAWS IN THE NINETEEN WESTERN STATES, VOL 11, Economic Research Service, Washington, D. C., Natural Resources Economic Div.
For primary bibliographic entry see Field 6E.

WATER ALLOCATION, Stanford Environmental Law Society, Calif. R. W. Harris, W. D. Jeffery, and B. W. Stewart, Jr. In: Instate Environmental Problem, p. 34-56, Stan-ford Law School, Stanford, California, 1974. 23 p.

Descriptors: \*Water allocation(Policy), \*Riparian rights, \*Appropriation, \*Federal-state water rights conflicts, \*Surface waters, Permits, Surface water availability, Urbanization, Prescriptive rights, Water law, Riparian waters, Federal government, Industrial water, Navigation, Reservation doctrine, History, Indian reservations, California, Groundwater, State governments, Water utilization, Diversion. tion. Diversion

Identifiers: California Doctrine, Navigation Servitude Doctrine, Newlands Project, Pyramid Lake, State policy.

This article examines three principal systems of water allocation in the United States: the riparian system of the humid East, the appropriation system of the arid West, and the often conflicting federal water law system. Under the riparian system, only the owner of land along a water-course has the right to reasonable use of water as it passes or crosses his property. This right is shared equally with other riparian owners. As water deequally with other riparian owners. As water demand has increased with urban and industrial growth, more states are adopting the appropriation system. Appropriated water rights are obtained by diversion to a beneficial use. As a prerequisite to diversion to a beneficial use. As a prerequisite to diverting water, most Western states require permits. However, all state systems must yield when in conflict with federal water law, which is largely court created and widely diverse. Two federal doctrines allow the United States to seize or impair water rights without paying compensation: these are the navigation servitude doctrine and the reservation doctrine. Both doctrines give federal courts great discretionary power in deciding water allocation. This is illustrated by an examination of federal decisions allocating water to Indian reservations. (Parrish-Ejorida) vations. (Parrish-Florida) W76-03920

EFFECT OF SOIL AND WATER CONDITIONS ON THE RURAL LANDSCAPE AROUND WOUW, NORTH BRABANT, (IN DUTCH), For primary bibliographic entry see Field 3F. W76-03922

COWANESQUE LAKE, COWANESQUE RIVER, TIOGA COUNTY, PENNSYLVANIA, (FINAL ENVIRONMENTAL IMPACT STATEMENT). Corps of Engineers, Baltimore, Md. For primary bibliographic entry see Field 8A. W76-03923

NAVAL SUBMARINE BASE, NEW LONDON, GROTON, CONNECTICUT DREDGE RIVER CHANNEL, VOLUME 1, (ENVIRONMENTAL IMPACT STATEMENT). Department of the Navy, Washington, D.C.

#### Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4A-Control Of Water On The Surface

For primary bibliographic entry see Field 8A. W76-03924

CORKSREW SANCTUARY: USE OF THE MAR-KET FOR PRESERVATION,

Environmental Protection Agency, Boston, Mass. For primary bibliographic entry see Field 6G.

FLOOD HAZARD AREAS.

Vermont State Agency of Environmental Conservation, Monpelier.
For primary bibliographic entry see Field 6F. W76-03934

GUIDELINES FOR DELINEATION OF FLOOD-WAYS AND FLOOD HAZARD AREAS Indiana State Dept. of Natural Resources, Indi-

anapolis. For primary bibliographic entry see Field 6F. W76-03935

MODEL ZONING ORDINANCE FOR FLOOD

HAZARD AREAS.
Indiana Dept. of Natural Resources, Indianapolis.
For primary bibliographic entry see Field 6F. W76-03936

SOME PROBLEMS OF LARGE IRRIGATION CHANNEL CONSTRUCTION IN DESERT CON-DITIONS, (IN RUSSIAN),

B. K. Balakaev Probl Osvoeniya Pustyn', 4, 41-46, Illus, 1974.

Descriptors: \*Deserts, \*Irrigation, \*Channels, \*Construction, Canals, Pumping, Crop production, River basins, Operations, \*Canal construc-Identifiers: \*USSR

Theoretical, field and laboratory studies were made of the problems of design, construction and exploitation of the V. I. Lenin Kara kum canal (USSR). Data were obtained concerning hydraulic conditions of operation, water losses in sandy desert and operating conditions of pumps. The results are useful for solving problems of water delivery a great distance from the basins of rivers by means of large channel construction in desert lands (for crop irrigation).--Copyright 1975, Biological Abstracts, Inc. W76-03972

#### 4B. Groundwater Management

DEALING WITH OIL SPILLAGE CONTAMINA-TION, National Water Well Association. Worthington.

For primary bibliographic entry see Field 5G. W76-03522

UNIQUE DESIGN IDEAS MAY INCREASE BIT

For primary bibliographic entry see Field 8C.

NEW LOG DATA GIVE BETTER NORTH SEA

WELL COMPLETIONS,
Conoco North Sea, Inc., London (England).
G. M. Hodson, W. H. Fertl, and G. W. Hammack.
World Oil, Gulf Publishing Company, p 60-65,
September 1975. 5 fig.

Descriptors: \*Borehole geophysics, \*Porosity, \*Permeability, \*Petrography, Reservoirs, Radioactive logging, Electric logging, Heavy

Identifiers: \*Mica, Zircon, \*North Sea, Spectro-

graphic gamma ray.

Several methods are illustrated of using geophysical well logs to determine reliable estimates of porosity and permeability where heavy minerals may mask important reservoir characteristics. The ithology of the area being studied consists of a sand/shale sequence, with decreasing grain size from top to bottom of the interval. The unit being studied was of Lower and/or Middle Jurassic Age. Porosity in the medium to coarse sands ranges from 20-30%, with a permeability range of 40 md to 15 darcies. The fine grained and silty reservoir rocks which have less porosity and lower permeability contain considerable quantities of mica, and other heavy minerals. It is difficult to develop a relationship between core derived porosity and horizontal permeability in units containing highly micaceous intervals. The ratio of horizontal to vertical permeability in clean sands is generally about 2:1, however, in micaceous sand intervals the ratio may exceed 10:1. Analysis of the geophysical logs showed the following: (1)Spontaneous potential curve was not able to delineate the clay from micaceous zones; (2) High gamma ray readings resulted from heavy minerals such as mica, zircon, and silt, especially when curves were superimposed upon the shale effect; (3) Neutron logs were unaffected by mica content; therefore, Density and Neutron logs can be utilized to qualitatively differentiate clay and mica on an overlay of compatible sealed porosity logs. Schlumberger's experimental Gamma Ray Spectroscopy Log has encouraging possibilities for improving quantitative mica and shale estimates to allow more accurate determination of effective porosity and reliable net sand count in micaceous sections. (Gass-NWWA) W76-03524

STOP LEACHATE PROBLEMS,

Lenard Engineering, Storrs, Conn. For primary bibliographic entry see Field 5B. W76-03525

A PRELIMINARY REPORT ON ANOMALOUS PRESSURES IN DEEP ARTESIAN AQUIFERS IN SOUTHEASTERN NORTH CAROLINA,

North Carolina Dept. of Natural and Economic Resources, Raleigh. Div. of Resources Planning and Evaluation.

H. M. Peek, and L. A. Register. Report of Investigation No 10, 1975. 19 p, 8 fig, 1

Descriptors: \*Hydraulic gradient, \*Potentiometric level, \*North Carolia, Recharge, Liquid waste, Osmotic pressure, \*Artesian wells, Coastal plains, \*Pressure, \*Artesian aquifers. Identifiers: \*Tectonic force, \*Anomalous pressure, Seismic activity, Great Carolina Ridge, Cape

Unusually high pressures occur in the deeper artesian aquifers beneath part of southeastern North Carolina. A series of ground water research stacaronia. A series of ground water lesearch satisfies, consisting of exploratory wells drilled to the basement rock and the significant aquifers, are being constructed. The area overlies a wedge of sedimentary rocks ranging in thickness from 200 feet along the western part to 1,500 feet along the southern part of the study area. These sediments range in age from Cretaceous to Recent. The piezometric surface of the aquifer unit forms a ridge roughly parallel to the coast. The configura-tion shows that these anomalous pressures are not related to recharge. Data indicate that the anomalous pressures in the lower unit of the Cretaceous aquifer system may be related to a rise in elevation of the land surface in southeastern North Carolina. The chloride distribution and configuration of the pressure surface indicate that the anomalous pressure gradient is a recent phenomenon. Changes in pressure may be used as an index of seismic activity in this area. (Gass-NWWA)

FILTER-PACK INSTALLATION REDEVELOPMENT TECHNIQUES FOR SHAL-LOW RECHARGE SHAFTS, Agricultural Research Service, Fresno, Calif.

Water Management Research. R. L. McCormick.

Ground Water, Vol 13, No 5, p 400-405, September-October 1975. 7 fig.

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Descriptors: \*Artificial recharge, Shafts(Excavation), \*California.

Identifiers: \*Recharge shafts, \*Filter-pack materials, Redevelopment techniques, F Leaky Acres Recharge Project(Calif). Fresno(Calif),

The potential for artificial ground water recharge through shallow shafts was conducted at the Leaky Acres Recharge Project in Fresno, California. The research was directed toward developing methods for constructing and placing filter-pack materials and procedures for periodically cleaning filter materials to regenerate initial intake rates. Preliminary results are presented of two differently constructed shallow shafts. Screened canal water was recharged into the shaft. In a combined period of 94 days, 50.8 X 1000 cubic meters of water were recharged at an average rate of 6.25 liters per second. Shaft No. 1 was regenerated to 109 percent of its original rate, but shaft No. 2 was regenerated to only 78 percent of its original rate. Redevelopment with a submersible pump was more efficient than a centrifugal pump in removing the clogging particles from the shaft-filter-pack materials. Piezometric head losses indicated that most of the clogging that occurred was contained within the filter-pack material. (Gass-NWWA) W76-03527

DANGER OF PESTICIDE POLLUTION OF AR-TIFICIALLY REPLENISHED GROUNDWATER RESERVES, (IN RUSSIAN),

Nauchno-Issledovatelskii Institut Epidemiologii, Mikrobiologii i Gigieny, Vilnius (USSR). For primary bibliographic entry see Field 5B. W76-03649

MECHANIZATION OF WATER-RAISING FROM THE WATER-ACCUMULATING WELLS 'CHIRLE', (IN RUSSIAN),
Akademiya Nauk Turkmenskoi SSR, Ashkhabad.

Research Inst. of Agriculture. O. B. Khellenov, and A. S. Ovezmuradov. Probl Osvoeniya Pustyn'. 4. 91-9. 1974.

Descriptors: Maps, Deserts, Water supply, Water wells, Grazing, Rangelands, Sheep. Identifiers: \*USSR, Turkmen SSR.

schematic map was compiled of the Turkmen SSR (USSR) desert range lands suitable for water supply by water-accumulative wells. The wells can sapply by water-accumulative weist. The weits can provide the watering for an area with grazing capacity of 1 million sheep. Technical require-ments were developed for mechanizing water-rais-ing.--Copyright 1975, Biological Abstracts, Inc. W76-03663

EFFECTS OF A SANITARY LANDFILL ON GROUNDWATER QUALITY IN ASHLAND, NEW HAMPSHIRE.

New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources. For primary bibliographic entry see Field 5C. W76-03721

UNSTEADY UNCONFINED FLOW INTO A SURFACE RESERVOIR,

Birmingham Univ. (England). Dept. of Civil Engineering. For primary bibliographic entry see Field 2F.

#### WATER QUANTITY MANAGEMENT AND CONTROL-Field 4

#### Groundwater Management—Group 4B

UNDERGROUND WATERS OF THE LOWER HUTT-A MODEL STUDY, Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Physics and Engineer-

For primary bibliographic entry see Field 2F. W76-03753

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THE FUTURE OF WATER RESOURCES IN NORTHEASTERN ILLINOIS, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 6D.

DEVELOPMENT OF IRON AND MANGANESE BACTERIA IN RANNEY WELLS, For primary bibliographic entry see Field 5B. W76-03761

GROUND-WATER RECHARGE SIMULATION, New South Wales Univ., Kensington (Australia). Faculty of Military Studies.

A. C. Amar. Journal of the Hydraulics Division Proceedings of ASCE, Vol 101, No. HY9, p 1235-1247, September, 1975. 6 fig, 17 ref.

Descriptors: \*Model studies, \*Recharge, \*Groundwater movement, \*Groundwater recharge, \*Simulation analysis, \*Mathematical studies, Equations, Aquifers, Flow, Analytical techniques, Hydrodynamics, Hydrologic aspects. Identifiers: Accelerated Liebman Method, Nonlinear potential theory.

The two-dimensional hydrodynamic behavior of recharge of an unconfined aquifer was formulated, based on nonlinear potential theory. The solution of this equation was presented based on the Accelerated Liebman Method. The flow was assumed to be unsteady and the aquifer medium was assumed to be saturated, homogeneous, and isotropic. Yhe validity of currently known analytical solutions for the various linearized cases was cal solutions for the various linearized cases was also examined. Comparisons were made between the dimensionless theory curves obtained and the pertinent experimental data. A correlation between classical D-F theory and potential theory demonstrated that, except under severely restricted values of certain parameters, the non-linear enterial theory was result the converse. restricted values of certain parameters, the non-linear potential theory may provide the answer for a correct description of the problem relating to the hydrodynamics of recharge. This analysis offered improvement in its accuracy and helped to explain some of the observed deviations between the known mathematical solutions and experimental data for several cases. The method developed may be applied to regional flow models involving nonhomogeneous and anisotropic solids, to systems with complicated geometry, and to three-dimensional cases. (Kramer-FIRL) W76-03801

NITRATES IN WISCONSIN GROUND WATER, Wisconsin State Lab. of Hygiene, Madison For primary bibliographic entry see Field 5B. W76-03803

CHANGES OF THE GROUNDWATER SUPPLY CONDITIONS IN CONNECTION WITH CONSTRUCTION OF RESERVOIRS (BASED ON EX-PERIENCE OF THE GORKI RESERVOIR, (IN RUSSIAN), Gorkovskii Meditsinskii Institut (USSR)

For primary bibliographic entry see Field 5C. W76-03804

THE CONTROL OF POLLUTION OF GROUND-

WATER,
Clyde River Purification Board, Glasgow (Scotland). For primary bibliographic entry see Field 5G. W76-03815

THE CONSTRUCTION AND OPERATION OF GRAVEL WELL SOURCES WITH PARTICULAR REFERENCE TO THOSE OF THE NENE AND OUSE WATER BOARD,

For primary bibliographic entry see Field 3B. W76-03817

GEOCHEMICAL FACTORS AFFECTING AR-TIFICIAL GROUNDWATER RECHARGE IN THE UNSATURATED ZONE, Geological Survey, Lubbock, Tex. For primary bibliographic entry see Field 5G. W76-03818

ASSESSING PHYSICAL POTENTIAL FOR DEEP DISPOSAL OF INDUSTRIAL WASTES BY WELLS IN THE SOUTHEASTERN UNITED

Virginia Polytechnic Inst. and State Univ., Virginia Polytechnic Inst. and State Univ., Blacksburg. Div. of Environmental and Urban

For primary bibliographic entry see Field 5E. W76-03840

THE EFFECT OF SANITARY LANDFILLS ON WATER QUALITY IN SOUTHERN INDIANA, Indiana Univ., Bloomington. Dept. of Geography. For primary bibliographic entry see Field 5B. W76-03851

APPENDIX 3, GEOLOGY AND GROUND WATER, GREAT LAKES BASIN FRAMEWORK

Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 2F. W76-03863

EVALUATION AND PROPOSED STUDY OF POTENTIAL GROUND-WATER SUPPLIES, GALLUP AREA, NEW MEXICO,

Geological Survey, Albuquerque, N. Mex. W. L. Hiss.

Open-file report 75-522, September 1975. 153 p, 4 fig, 2 tab, 243 ref.

Descriptors: \*Groundwater resources, \*Water supply, \*Municipal water, \*Water resources development, \*New Mexico, Planning, Surveys, Reviews, Water demand, Publications, Bibliographies, Evaluation, Hydrologic data, Water quality. Identifiers: \*Gallup(N Mex).

The groundwater potential of 5 areas in central-western New Mexico within 85 miles of Gallup, N. Mex. was evaluated by reviewing published literature (bibliography included in report), inspecting aerial and space photographs, and interviewing ranchers and personnel employed by well-drilling and mineral-exploration companies. The San Andres Limestone and underlying Glorieta Sandstone of Permian age are the oldest aquifers capable of yielding water of a quality suitable for municipal use. The San Andres-Glorieta aquifer is a potential source of water for the city of Gallup south and southwest of the Zuni Mountains in the North Plains-Malpais and Zuni Southwest areas of this report. Without artificial stimulation of wells, the San Andres-Glorieta aquifer system should yield 100 gpm of water containing 500 to 1,000 mg/litre dissolved solids from depths ranging from 2,000 to 3,500 ft. Artificial stimulation by acidization and hydraulic fracturing of wells tapping the aquifer system could increase the yields several fold. (Woodard-USGS) W76-03905

WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1975.

Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 7C. W76-03907

SUMMARY OF HYDROLOGIC CONDITIONS AND EFFECTS OF WALT DISNEY WORLD DEVELOPMENT IN THE REEDY CREEK IM-PROVEMENT DISTRICT, 1966-73, Geological Survey, Winter Park, Fla. For primary bibliographic entry see Field 4C. W76-03908

THE WATER TABLE ON LONG ISLAND, NEW YORK, IN MARCH 1974, Geological Survey, Mineola, N.Y.

Ceological Survey, Marches E. J. Koszalka.

Long Island Water Resources Bulletin LIWR-5,
Suffolk County Water Authority, 1975. 7 p, 1 fig. 3 plate, 15 ref.

Descriptors: \*Water levels, \*Water table, \*Maps, \*Contours, \*Oberservation wells, New York, Basic data collections, Hydrologic data, Water level fluctuations, Measurement. Identifiers: \*Long Island(N.Y.).

Maps of water-level measurements in 364 observa-tion wells in Long Island, N.Y., in March 1974 show that the altitude of the water table ranged from more than 10 feet below sea level in eastern from more than 10 feet below sea level in eastern Queens County to nearly 120 feet above mean sea level in northwestern Nassau County. The water table rose considerably during the period 1970-74 throughout most of Long Island in response to the above-normal precipitation during 1972 and 1973. In Kings County, the net rise in water levels was generally less than 4 feet. In western Queens County, a maximum rise of about 8 feet was recorded, but in eastern Queens County water levels declined about 4 feet. Net water-level rises generally ranged from 2 to 11 feet in northern Nassau County and were less than 4 feet in the southeastern part of the county. In southwestern Nassau County, however, water levels declined Nassau County, however, water levels declined locally by nearly 4 feet. In western and central Suffolk County, a maximum net rise of about 8 feet was recorded. In eastern and southern Suffolk County, net rise was less than 4 feet. (Woodard-W76-03911

HARFORD COUNTY GROUND-WATER IN-FORMATION: WELL RECORDS, CHEMICAL QUALITY DATA, AND PUMPAGE, Geological Survey, Parkville, Md. For primary bibliographic entry see Field 7C.

W76-03912

WATER RIGHTS LAWS IN THE NINETEEN WESTERN STATES, VOL 11, Economic Research Service, Washington, D. C.,

Natural Resources Economic Div. For primary bibliographic entry see Field 6E. W76-03916

NEEDED: A GROUND-WATER TREATY BETWEEN THE UNITED STATES AND MEX-

B. G. Burman, and T. G. Cornish. Natural Resources Journal, Vol 15, p 385-404 (1975). 20 p, 69 ref.

Descriptors: \*Mexico, \*Southwest U.S., \*Water table, \*Groundwater, \*Treaties, Regulation, Legal aspects, International law, Groundwater resources, Groundwater mining, Water law, State governments, Federal government, Competing uses, Water allocation(Policy), Groundwater availability, Subsurface waters, Water sources, Water supply, Irrigation, Potable water, \*United States, Water demand.

The increasing water needs of the expanding population in the Southwest cannot be met by the available surface water. Already the cities and farms in this area are using the reserves of underground water. As a result of this increased use of groundwater, the water table is being lowered at

#### Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4B-Groundwater Management

an alarming rate. The need for closer regulation of groundwater resources cannot be handled effectively by either the United States or Mexico acting unilaterally. A treaty between the United States and Mexico is necessary to regulate groundwater reserves. This treaty most involve both nations as sovereign bodies. Although the affected States should be consulted, the needs of the various States must ultimately be subservient to the greater national purpose and to federal regulation. (Nursey-Florida) W76-03918

GEOTHERMAL LEASING PROGRAM, VOLS. II AND III--LEASING OF GEOTHERMAL RESOURCES IN THREE CALIFORNIA AREAS (FINAL ENVIRONMENTAL IMPACT STATE-

MENT).
Department of the Interior, Washington, D.C. Available from the National Technical Information Service, Springfield, Va 22161 as EIS-CA-73-1681-F-2. October 24, 1973, 547 p, 30 map, 39 photo, 68 tab, 2 dia.

Descriptors: \*Environmental effects, \*Geysers, \*California, \*Geothermal studies, \*Thermal power, Thermal water, Subsurface waters, Hydrothermal studies, Federal government, Administrative agencies, Thermal power plant, Electric power production, Hot springs, Steam, Water temperature, Leases, Pacific Coast region, Southwest U.S., Land, Land use, Forests, Agriculture, Grazing, Recreation, Wildlife habitats. Agriculture, habitats.

Identifiers: \*Environmental Impact Statement, Geothermal resources.

Leasing of federally owned potential geothermal resources in The Geysers Known Geothermal Resource Area near the San Francisco, California, is the subject of the proposed project. The lands under consideration presently are used for graz-ing, forestry, mining, fish and wildlife habitat, out-door recreation, and watersheds. As a result of the project, land would be restricted from uses such as wildlife habitat, recreation, and grazing. Terrain would be modified through construction of roads, wells, pipelines, and industrial facilities. Possible adverse effects include noise and noxious gas emissions, and land subsidence. Alternatives considered were: (1) postpone leasing, (2) decline leasing, (3) limit leasing to natural resource or mineral rights lands, (4) lease selected areas, and (5) lease only a prototype area. In order to gain long-term benefits of electrical production, some short-term uses of the area for recreation and wildlife habitat uses of the area for recreation and widdle habitat must be sacrificed. The principal commitment of resources would be depletion of thermal energy and alteration of the vegetative cover, togethen with irretrievable expenditures of capital and labor for construction of installations. (Fernandez-Florida) Florida) W76-03925

FINITE ELEMENT SOLUTIONS TO TWO GROUNDWATER FLOW PROBLEMS - ONE IN-CLUDING DISPERSION AND THE OTHER THE INFLUENCE OF ELECTRO-OSMOSIS, California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.

For primary bibliographic entry see Field 5B. W76-03962

POLLUTANT MOVEMENT TO GROUND WATER FROM SWINE WASTE LAGOONS, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy. For primary bibliographic entry see Field 5B. W76-03973

GROUNDWATER CONTAMINATION CAUSED WASTE WATERS GENERATED IN GAL VANIZING PLANTS (GALVANUZEMI SZEN- NYVIZ ALTAL OKOZOTT TALAJVIZSZEN-NYEZESEK),
For primary bibliographic entry see Field 5B. W76-03996

4C. Effects On Water Of Man's Non-Water Activities

FLOOD HAZARD PATTERNS OF URBAN DEVELOPMENT IN THE UPPER MIDWEST, Western Illinois Univ., Macomb. Public Policy For primary bibliographic entry see Field 4A. W76-03627

HANLON CREEK ECOLOGICAL STUDY, PHASE A.
Guelph Univ. (Ontario). Centre for Resources Development. For primary bibliographic entry see Field 5G. W76-03629

FREEWAY STORM RUNOFF WILL BE CLARIFIED. Michigan Dept. of State Highways, and Transportation, Lansir For primary bibliographic entry see Field 5D. W76-03718

USE OF SATELLITE DATA IN URBAN HYDROLOGIC MODELS,
Maryland Univ., College Park. Dept. of Civil Engineering. For primary bibliographic entry see Field 7B. W76-03748

PERFORMANCE OF PENNSYLVANIA HIGHWAY DRAINAGE INLETS Lehigh Univ., Bethlehem. Dept. of Civil Engineer-For primary bibliographic entry see Field 8B.

STORMFLOWS AND EROSION AFTER TREE-LENGTH SKIDDING ON COASTAL PLAIN

Forest Service (USDA), Oxford, Miss. Southern Forest Experiment Station. B. P. Dickerson.

W76-03750

Transactions of the American Society of Agricultural Engineers, Vol 18, No 5, p 867-868, and 872, September-October 1975. 3 fig, 6 ref.

Descriptors: \*Storm runoff \*Erosion \*Mississippi, Forest soils, Regression analysis, Trees, Storm surge, Forestry, Coastal plains, Soils, Slope protection, Soil erosion, Forests, Lumbering.
Identifiers: Tree-length skidding, Forest floor, Hardwood logs.

A 2-year study in northern Mississippi defined increases in stormflow and sediment from areas disturbed by upslope skidding of tree-length logs with a rubber-tired skidder. On 20 slopes, storm-flow volumes averaged 28.4 cm, or about 11% of the total rainfall. Soil loss averaged 14.8 kg per trail in the first year but diminished rapidly as herbaceous vegetation occupied bared soil. In contrasts, stormflows from the undisturbed plots averaged only 2.8 cm for the two years. Stormflow from undisturbed plots were fairly uniform, but those from skid trails varied considerably. Sediment production during the study averaged 16.56 kg per trail with a standard error of + or - 3.04 kg. Seventy-five percent of the total sediment loss oc-curred during the first 6 months, and sediment yields were highest in May and July, when rainfall was above normal monthly averages. Results of this study were not applicable to all stands on Coastal Plain soil. (Roberts-ISWS) W76-03756

ACID ROCK IN THE GREAT SMOKIES: UNAN-TICIPATED IMPACT ON AQUATIC BIOTA OF ROAD CONSTRUCTION IN REGIONS OF SUL FIDE MINERALIZATION,
Oak Ridge National Lab., Tenn. Environmental For primary bibliographic entry see Field 5C. W76-03770

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RELATIONSHIPS BETWEEN PRECIPITATION, RELATIONSHIPS BETWEEN PRECIPITATION, STREAM WATER CHEMISTRY, AND VEGETATION FOR THE BOWL, A FORESTED WATERSHED IN NEW HAMPSHIRE, New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources. For primary bibliographic entry see Field 4D. W76-03875

STREAM QUALITY IN RELATION TO MINE DRAINAGE IN COLORADO, Geological Survey, Denver, Colo. For primary bibliographic entry see Field 5B. W76-03900

THERMODYNAMIC CONSTRAINTS METAL SOLUBILITIES IN A STREAM AF-FECTED BY MINE DRAINAGE, BONANZA, COLORADO,

Geological Survey, Denver, Colo. For primary bibliographic entry see Field 5B. W76-03901

RAINFALL-RUNOFF RELATION FOR REDWOOD CREEK ABOVE ORICK, CALIFOR-NIA.

Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 2A. W76-03903

SUMMARY OF HYDROLOGIC CONDITIONS AND EFFECTS OF WALT DISNEY WORLD DEVELOPMENT IN THE REEDY CREEK IMPROVEMENT DISTRICT, 1966-73, Geological Survey, Winter Park, Fla.

A. L. Putnam. Florida Bureau of Geology, Tallahassee, Report of Investigations No 79, 1975. 115 p, 30 fig, 13 tab, 5

Descriptors: \*Hydrologic data, \*Land development, \*Environmental effects, \*Water quality, \*Runoff, Florida, Basic data collections, Groundwater, Surface waters, Streamflow, Chemical analysis, Evaluation, Construction, Urbanization, Properties feelilities. Recreation facilities Identifiers: \*Walt Disney World(Fla).

The Reedy Creek Improvement District (RCID) is an area of about 43 sq mi in southwest Orange and northwest Osceola Counties, Fla. Before develop-ment of Walt Disney World began (mid-1967), all of this tract was scrubby flatlands and swamp. Walt Disney World facilities now (1974) occupy slightly less than 10 percent of the area. Hydrologic data are available for most of the area for the year period July 1967-June 1973, with some records starting before July 1967. The potentiometric surface of the Floridan aquifer near Bay Lake has declined 8 feet on the average. Seventyfive percent of the decline is attributed to water use in the RCID; the remaining decline is attributed to deficient rainfall since the records began in March 1966. The discharge of streams in the RCID has increased. However, the hydrologic conditions were changing locally as the develop-ment of the area progressed. Because of this change, the magnitude and seasonal distribution of any eventual change in streamflow cannot be ac-

### WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Identification Of Pollucants-Group 5A

curately appraised until additional data are obtained after the development has stabilized. In general, the quality of the water in the area is good. The dissolved-solids concentration is low good. The dissolved-solids concentration is low with surface water generally less than 90 mg/litre and with groundwater generally less than 150 mg/litre. Color ranges from 0 to 40 units for groundwater and from 10 to 600 units for surface water. There is no indication of a detrimental effect on water quality from the influence of development. (Woodard-USGS) W76-03908

#### 4D. Watershed Protection

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HANLON CREEK ECOLOGICAL STUDY. PHASE A.
Guelph Univ. (Ontario). Centre for Resources Development.

For primary bibliographic entry see Field 5G. W76-03629

BULL RUN SAFE YIELD STUDY, For primary bibliographic entry see Field 4A. W76-03792

EFFECT OF FLOW RATE AND CANOPY ON

RILL EROSION,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab. For primary bibliographic entry see Field 2J. W76-03861

APPENDIX 12, SHORE USE AND EROSION, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 2J. W76-03866

APPENDIX 18, EROSION AND SEDIMENTA-TION, GREAT LAKES BASIN FRAMEWORK STUDY.

Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 2J. W76-03870

RELATIONSHIPS BETWEEN PRECIPITATION, STREAM WATER CHEMISTRY, AND VECETATION FOR THE BOWL, A FORESTED WATERSHED IN NEW HAMPSHIRE, New Hampshire Univ., Durham. Inst. of Natural

and Environmental Resources. C. W. Martin.

M.S. Thesis, May 1975. 67 p, 20 fig, 10 tab, 54 ref.

Descriptors: \*Forest management, \*New Hampshire, Precipitation(Atmospheric), Streams, Nutrients, Forest watersheds, Hydrology, Geology, Soils, Vegetation, Biology, Meteorology, Ecosystems, Water chemistry, Chemistry of precipitation, On-site investigations. dentifiers: \*White Mountains(NH), \*The Bowl(NH), Stream water chemistry, Wood products, Stream chemistry, Ionic balance.

The study was designed to study the flow of plant nutrient elements through a watershed covered by a northern hardwood forest that has had negligible human disturbance. Research was conducted in the Bowl Natural Area located in the White Moun-tain National Forest near Wonalancet, New tam National Forest near Wonalancet, New Hampshire. Precipitation was measured by a net-work of rain gages established for the study and streamflow was estimated from a nearby USFS stream gage. Nitrate, sulfate, bicarbonate, chloride, inorganic phosphate, calcium, magnesium, sodium, potassium, pH, ammonium, electrical conductivity, dissolved silica, and turbidity were resourced on stream waster samples and composite measured on stream water samples and composite precipitation collected once every two weeks from May 1973 through September 1974. A survey of the woody vegetation was conducted during the summer of 1974 to estimate the biomass and species distribution within the area. A mature steady state forest covers the 607 ha tract with a mixture of old (300 yr) and young (30 yr) stands of predominantly tolerant northern hardwoods and conifers. There were no noticeable seasonal trends in the nutrient outputs. This was significant for nitrate, indicating that the steady state forest did not increase its uptake of nitrate during the growing season as would be expected in a highly productive forest. The summer nitrate concentrations in the stream water wear the season as tions in the stream water were the same as those of the dormant winter season. (Roberts-ISWS) W76-03875

WATER AND WATERCOURSES-FEDERAL JURISDICTION-FEDERAL COMMON LAW DETERMINES OWNERSHIP OF RE-EXPOSED NAVIGABLE RIVER BEDS-BONELLI CATTLE CO. V. ARIZONA,

For primary bibliographic entry see Field 6E. W76-03919

OVERSNOW RUNOFF EVENTS AFFECT STREAMFLOW AND WATER QUALITY, Forest Service (USDA), Laramie, Wyo. Forest Range and Watershed Lab. D. L. Sturges.

In: Proceedings, Snow Management on the Great Plains Symposium, July 29, 1975, Bismarck, North Dakota, p 105-117, 6 fig, 3 tab, 2 ref. Research Committee, Great Plains Agricultural Council, Publication No 73.

Descriptors: Surface runoff, \*Suspended load, \*Bedload, \*Water quality, \*Melt water, \*Intermittent streams, \*Snowmelt, \*Sagebrush, Water yield, Watershed management, Snow, Snowpacks, Hydrographs.
Identifiers: \*Oversnow flow, Big sagebrush, Supported technique. Suspended sediment.

Oversnow flow, the movement of snowmelt water across the snow surface, primarily in intermittent drainages, has important hydrologic implications. Maximum flow rates on a big sagebrush watershed were increased three to five times in years with the were increased three to five times in years with the flow and snowmelt runoff, expressed as a percent of winter precipitation, was four times as large. Water is quickly conveyed off the watershed so that soil moisture recharge and deep seepage losses are minimized. The most important factor triggering oversnow is probably a constriction in flow at the ground-snow interface since intermitent drainages do not have a preformed change to tent drainages do not have a preformed channel to carry water. Oversnow flow develops when prolonged, high snowmelt rates occur at the beginning of snowment. Daily melt exceeded 1 inch per day when snow covered sagebrush plants and was greater than 2 inches per day when the snow level was within sagebrush foliage. Increased sediment movement accompanied oversnow runoff events. Suspended sediment concentration reached 862 ppm while oversnow flow was occurring in comparison to levels that are less than 20 ppm in years lacking the flow. Annual coarse sediment deposition was also highest in years with the flow and ranged from 8 to 179 cu ft per sq mile for all years. Deposition was 6 and 12 times greater than the average rate for years without oversnow runoff. (Forest Service) W76-03965

SEDIMENT TRANSPORT FROM BIG SAGEBRUSH WATERSHEDS, Forest Service (USDA), Laramie, Wyo. Forest Range and Watershed Lab.

D. L. Sturges. D. L. Stulges.

In: Proceedings, Watershed Management Symposium, August 11-13, 1975, Logan, Utah, Utah State University, p 728-738. 3 fig, 6 tab, 4 ref. Descriptors: \*Sediment transport, \*Sediment discharge, \*Suspended load, \*Water quality, Streams, \*Sedimentation rates, Suspension, \*Sagebrush, Deposition, \*Bedload, Watershed management, Range management, Wyoming. Identifiers: Suspended sediments, Bedload deposition, \*Oversnow flow, Big sagebrush.

Suspended sediment and bedload transport are discussed for two watersheds vegetated with big sagebrush that have perennial flow. Average suspended sediment content of water during the 1974-75 winter was 6 ppm and ranged from 1 to 28 ppm. Suspended sediment levels increased sharply as snowmelt runoff began, peaked at about the same time as maximum runoff, but then fell much faster than streamflow recession. Suspended sediment exceeded 100 ppm on 12 december 2018. ment exceeded 100 ppm on 13 days during snow-melt runoff in 1974 and had a maximum value of 399 ppm. Suspended sediment content exhibited a 399 ppm. Suspended sediment content exhibited a diurnal fluctuation in streamflow volume. Sediment levels gradually declined through the 1974 summer period from about 20 ppm in late June to less than 10 ppm by October. Both suspended movement and runoff rates have been greatest during overand funorir rates have been greatest during over-snow flow, a unique hydrologic phenomenon. The suspended sediment concentration reached 862 ppm at one watershed during oversnow flow in comparison to a usual level less than 20 ppm dur-ing snowmelt runoff. Annual bedload deposition ranged from 0.09 to 3.88 cu m per sq km and was highest in years with oversnow flow. The sagebrush watersheds had annual bedload depositions that were similar to rates reported for tim-bered, subalpine lands. (Forest Service) W76-03966

#### 5. WATER QUALITY MANAGEMENT AND PROTECTION

#### 5A. Identification Of Pollutants

TENTATIVE REFERENCE METHOD FOR THE MEASUREMENT OF GROSS ALPHA AND GROSS BETA RADIOACTIVITIES IN ENVIRONMENTAL WATERS.

VIRONMENTAL WATERS.
National Environmental Research Center, Las Vegas, Nev. Technical Support Lab.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-246 063, \$10.50 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-680/4-75-005, June 1975. 17 p., 5 ref, append. EPA 1HA327.

Descriptors: "Pollutant identification, Measurement, Methodology, Radioactivity, Water chemistry, "Radioactive mastes, "Standards. Calibration, "Radioactive wastes, "Standards. Identifiers: Radiation chemistry, Quality as-

A tentative reference method for the measurement A tentative reference method for the measurement of gross alpha and gross beta radioactivities in environmental waters is described. Samples of environmental water sources are collected, preserved by acid treatment, and aliquots of the samples are evaporated to dryness in a counting dish and counted for alpha and beta activity. Counting efficiencies for sample aliquots are read from curves prepared from counting data of prepared standards, using a known quantity of cesium-137 and 0-10 milligrams of evaporated water dissolved solids per square centimeter of counting dish area for gross beta, and a known quantity of americium-241 and 0-5 milligrams of evaporated water dissolved solids per square centimeter of counting dish area for gross beta, and a known quantity of americium-241 and 0-5 milligrams of evaporated water dissolved solids per square cenevaporated water dissolved solids per square cen-timeter of counting dish area for gross alpha. Results are reported in pCi/liter. (EPA) W76-03528

APPLICATION OF PULSE POLAROGRAPHY TO POLLUTANT ANALYSIS,

Princeton Applied Research Corp., Princeton, N.J.

#### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

#### Group 5A-Identification Of Pollutants

H. Siegerman, G. O'Dom, and J. Flato. In: Electrochemical Contributions to Environmental Protection, Theodore R. Beck, et al, editors. The Electrochemical Society, Inc., Prince New Jersey, 1972, p 76-87. 12 fig, 1 tab, 12 ref.

Descriptors: \*Analytical techniques, \*Heavy metals, Polarographic analysis, \*Pollutant identifi-cation, Cadmium, Lead, Zinc, Copper, Industrial wastes, Electrodes, Organic compounds, Elec-Identifiers: \*Pulse polarography, \*Differential pulse anodic stripping, Pottery glaze, Blood.

The differential pulse anodic stripping method (DPAS) is an electroanalytical technique for determination of small voltammetry. The amalgam metals are reoxidized to their component ions with metals are reoxidized to their component ions with waveforms which minimize charging current distribution and allows application of signal-processing techniques to minimize extraneous noise. This combination increases the sensitivity over anodic stripping voltammetry. Zinc and copper determinations in a prepurified acetate buffer were more sensitive with the DPAS method. When zinc and cadmium were quantitated by the standard additions method, a linear rela-tionship existed between peak heights and concentration. The DPAS method can be used to determine zinc, lead, and cadmium in pottery glaze; lead in plant effluent; heavy metals (copper, lead, cadmium, and zinc) in tap water; and lead in blood after perchloric-sulfuric acid digestion. With the Kemula-type hanging mercury drop electrode, sensitivities in ppb can be achieved with only a few minutes deposition time. The use of wax-im-pregnated graphite electrodes is described. The differential pulse polarographic technique can also be used to analyze objectionable organics; it is rapid, sensitive, and reproducible for heavy metal analysis at very low concentrations. (Buchanan-Davidson-Wisconsin) W76-03529

THE SQUARE-WAVE POLAROGRAPH AND ITS APPLICATION TO THE DETERMINATION OF HEAVY METALS IN THE ENVIRONMENT. Iowa Univ., Iowa City. Dept. of Chemistry.

E. B. Buchanan

In: Electrochemical Contribution to Environmen-The Electrochemical Contribution to Environmental Protection, Theodore R. Beck, et al., editors.
The Electrochemical Society, Inc., Princeton, New Jersey, 1972, p 88-98. 2 fig, 9 ref. EPA AP

Descriptors: \*Polarographic analysis, \*Heavy Descriptors: "Folarographic analysis, "Heavy metals, "Analytical techniques, Instrumentation, Electric currents, Electrolytes, Lead, "Iowa, Ha-lides, Electrodes, Chemical properties, Elec-trochemistry, "Pollutant identification. Identifiers: "Square-wave polarography, "Iowa Pitterflows" River(Iowa).

Square-wave polarography can measure 1 ppb metal ions directly, but the instrumentation is complex. The method for measuring current is inefficient, cell resistance must be minimized, and the electric signal decreases as chemical species causing the electrical signal decrease. New instrumentation has helped reduce these problems. Compared to conventional d-c polarography, square-wave polarography has greater sensitivity, increased selectivity, a common base line between successive peaks, and deaeration can sometimes be omitted. Of the electrolytes evaluated for lead determination in Iowa River water at Iowa City, greater sensitivity was observed when halides were used. An interfering hump in the polarogram disappeared when sodium fluoride was used, but etching was a problem. A mixture of sodium fluoride (to provide reversibility for electrode reactions) and perchlorate (for conductivity) at an optimum pH of 3 helped. The amplitude and frequency of the applied square-wave, gate position, and duration affected measurement sensitivity. The single parameter controlling sensitivity was the time delay between square-wave transi-

tion and gate opening. Current increased as a function of time for five minutes after deaeration ceased, then remained constant. River samples showed a large increase in lead in the spring when snow from city streets dumped on the frozen river melted. (Buchanan-Davidson--Wisconsin) W76-03530

GULF GENERAL ATOMIC PHENOL MONI-

TOR, Gulf General Atomic, Inc., San Diego, Calif. B. D. Enstein

In: Electrochemical Contribution to Environmental Protection, Theodore R. Beck, et al., editors. The Electrochemical Society, Inc., Princeton, New Jersey, 1972, p 99-107. 6 fig, 2 ref.

\*Phenols. \*Industrial Descriptors: Electrochemistry, Specwastes Monitoring, trophotometry, Water quality, Analytical techniques, Hydrogen ion concentration, Effluents, \*Pollutant identification. Identifiers: \*Phenol monitor, Oil refineries.

The phenol monitor developed by Gulf General Atomic uses electrochemical and spec-trophotometric principles to measure phenols in waste water on a semicontinuous basis. The spectral shift of samples undergoing a pH change was used to detect and quantitate different phenols. Above pH 12, ionized phenols like those in industrial wastes had absorption maxima about 290 nm. In protonated phenols, the maximum shifted to shorter wavelengths. Protonation was complete below pH 2. Phenol absorbance was monitored at 290 nm, when the pH was changed from 12 to 2. The angle beam optical system with regulated light source was self-cleaning. A self-cleaning electrochemical cell controlled the pH. Pre-electrolysis filters removed insoluble particulate matter. The monitor, electrolysis cell, timing of automatic sequences controlling pH, data acquisition, and analysis are described. The phenol concentration in San Diego tap water from the Colorado River was satisfactory despite high calcium and magnesium concentrations. Hydroxybenzene resium concentrations. Hydroxybenzene (phenol), p-aminophenol, p-methoxyphenol, 2,5-xylenol, 3,4-xylenol, and p-chlorophenol were measured. Phenol was determined in synthetic waste waters and refinery effluents. In field tests, some plugging of the inlet filter was encountered. some pugging of the injet futer was encountered. When sample flow was good, instrument response was reasonably stable. Results were higher than those obtained by the 4-aminoantipyrine method. (Buchanan-Davidson-Wisconsin) W76-03531

ANALYSIS OF SEWAGE LAGOON BIOMASS WATER SOLUBLE VITAMINS
MICROBIOLOGICAL TECHNIQUES,
Findlay Coll., Ohio. Div. of Natural Sciences.

N. M. Bakaitis.

In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 110-115. 15 ref, 2 tab.

\*Sewage lagoons, Descriptors: \*Biomass, Aerobic treatment, Municipal wastes, Vegetation, Water pollution sources, Proteins, Nutrients, Carbohydrates, Lipids, Sweet corn, Barley, Alfalfa, Sugar beets, Soybeans, Vitamin B, Calcium, Zinc, Manganese, Lagoons, Water pollution sources, Feeds, Chemical analysis, Byproducts, Aerated lagoons, \*Pollutant identifi-

Identifiers: Riboflavan, Biotin, Choline, Niacin, Pantothenic acid, Thiamine, Vitamin B(6).

Biomass from the Deshler, Ohio, aerobic sewage lagoon compares favorably in protein, fat, car-bohydrate, mineral, and vitamin content with commercial feeds, such as alfalfa, ear corn, dried barley, sugar beet pulp, and solvent-extracted soybean hulls. The biomass contains more riboflavin and comparable amounts of biotin, choline, niacin, patothenic acid, and thiamine, and

less amounts of vitamin B(6) than the commercial feeds. The mineral content of the biomass also compates favorably with these feeds being higher in calcium and zince but lower in manganese. (See also W76-03541) (Witt-IPC)

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COLIFORM AND PHYTOPLANKTON STUDIES IN A BRACKISH WATER AQUACULTURE POND FERTILIZED WITH DOMESTIC WASTEWATER,

Washington Univ., Seattle.

R. F. Donnelly, and T. T. Inouye.
In: Wastewater Use in the Production of Food and Fiber--Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 404-411. 4 fig, 7 ref.

Descriptors: \*Coliforms, \*Aquiculture, \*Phytoplankton, \*Brackish water, \*Sewage treat-ment, Seawater, Bacteria, Aquatic bacteria, Water pollution treatment, Water pollution control, Aquatic plants, Sewage effluents, Pathogenic bac-teria, Fertilizers, Nutrients, \*Pollutant identifica-

Identifiers: Anacystis, Ankistrodesmus.

Samples of coliforms and phytoplankton were taken from an aquaculture pond containing a sewage effluent-seawater mixture during two different seasons (April 15 through May 27 and September 27 through October 31). The data appears to support the hypothesis that there is a direct relationship between Anacystis and coliforms. A nega-tive correlation existed for Ankistrodesmus and coliforms. Since previous studies demonstrated that bacteria utilize the organics secreted by phytoplankta and that phytoplankta utilize inorganic nutrients generated from bacterial breakdown of organic materials, it is suggested that there may be a nutrient interrelationship between Anacystis and coliforms. (See also W76-03541) (Witt-IPC) W76-03568

A SEMIAUTOMATED PROCEDURE FOR THE DETERMINATION OF PHOSPHORUS IN WATER, WASTE WATERS AND PARTICU-

LATES, New York State Dept. of Health, Albany. E. Canelli, and D. G. Mitchell. Water Research, Vol 9, No 12, p 1093-1098, December, 1975. 3 fig, 10 ref, 4 tab.

Descriptors: \*Phosphorus compounds, \*Water Descriptors: "Prosphorus compounds, "water analysis, Analytical techniques, Water, Waste water(Pollution), Dissolved solids, Phosphorus, Phosphates, Silicates, Water chemistry, Water properties, Colorimetry, Chemical analysis, "Pollutant identification, Water pollution sources.

Improved procedures for the determination of total dissolved phosphorus (TDP), particulate phosphorus (PP), and dissolved inorganic orthophosphate (DP) are described. Organic particulate material is solubilized in 5 normal NaOH, and phosphorus compounds are oxidized and mineralized to orthophosphate by persulfate digestion. DP is determined by an improved automated molybdenum blue procedure that does not require sample pH adjustment or a correction for silicate interference in the 0-50 mg Si/liter range. The use of 36-position digestion racks allows 32 TDP or PP samples to be digested in about 1 and 4 hr, respectively. Detection limits in micrograms of phosphorus/liter are DP, 2; TDP, 5; and PP, 1. Waste water samples were analyzed for TDP and PP by the nitric acid-sulfuric acid procedure and by the proposed method. There was no significant difference between the two sets of data. (Witt-IPC) W76-03579

SELECTIVE SEPARATIONS BY REACTIVE ION EXCHANGE, PART II, PRECONCENTRA-

TION AND DETERMINATION OF COMPLEX IRON CYANIDES IN WATERS, State Univ. of New York at Binghamton. Dept. of

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G.O. Ramseyer, and G. E. Janauer. Analytica Chimica Acta, Vol 77, p 133-143, July, 1975, 5 tab, 48 ref.

Descriptors: \*Heavy metals, \*Pollutant identifica-tion, \*Pollutants, \*Iron compounds, \*Cation exchange, Water quality, Chemical precipitation, Analytical techniques, Separation techniques, Spectrophotometry, Columns, Aqueous solutions. Identifiers: \*Reactive ion exchange, \*Iron cya-nides, \*Preconcentration, \*Hexacyanoferrate, \*Cyanide, Copper ions, Ion exchange columns, Atomic absorption. Atomic absorption.

New York State law has established 400 ppb as the total amount of hexacyanoferrate(II) and (III) permissible in fresh water. Previous methods to measure these compounds were not sensitive to the ppb level or were not reliable due to less than quantitative yields. A new method using reactive ion exchange is described which permits preconion exchange is described which permits precon-centration of ppb levels of hexacyanoferrate(II) and(III) from aqueous solutions with high efficien-cy and minimal cost and effort. The in situ precipitation of copper hexacyanoferrate(II) or (III) preconcentrates the complex cyanides on shallow beds of sulfonated cation-exchange resin in the copper(II) form. Hydrochloric acid reactivebe elutes other cations including concomitant iron species from the resin bed and, finally aqueous ammonia reactively releases and elutes the hexacyanoferrate(II) or (III) through the formation of the copper-ammine complex. Final determination of the complex cyanides is performed by atomic absorption spectrometry for iron. (Davis-Vanderbilt) W76-03583

ORGANIC COMPOUNDS IN PULP MILL LAGOON DISCHARGE,

Washington Univ., Seattle. Coll. of Forest Resources

B. F. Hrutfiord, T. S. Friberg, D. F. Wilson, and J.

Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-246 900, \$4.50 in paper copy, \$2.25 in microfiche. Environ-mental Protection Agency, Report EPA-660/2-75-028, June 1975. 61 p, 14 fig, 16 tab, 24 ref. EPA 18B037

Descriptors: \*Pollutant identification, \*Aerated lagoons, Resins, Acids, Mass spectrometry, \*Pulp wastes, Organic compounds, \*Organic acids, Phenols, Industrial wastes, Waste water treat-

Identifiers: \*Kraft mill effluents, Fatty acids, Teopenes, Sugar acids, Resin acids

Organic compounds entering and leaving kraft mills aerated lagoons have been identified and determined quantitatively. The compounds found were terpenes and related low B.P. materials, resin were terpenes and related low B.P. materials, resin and fatty acids, phenols and sugar acids. The ter-penes, resin and fatty acids are similar to those present in the wood specie being pulped. Some ter-penes, phenols and sugar acids are produced dur-ing the pulping reactions. About 8 ppm total ter-penes were found in the lagoon influent and 1 ppm or less were in the effluent. Alpha-Terpineol was the major compound entering the lagoon and camphor the main terpene in the effluent. The total resin acid concentration entering the lagoon was 3.2 ppm with 0.6 ppm leaving. Fatty acids were ower both entering and leaving the lagoon. Sugar acids were found at about 100 ppm total entering, these were usually completely eliminated in the lagoon. Control of terpenes can be done by inprocess steam stripping and the other compounds can be partially controlled by in-plant spill contain-ment. (EPA) W76-03631

TRITIUM FRACTIONATION IN PLANTS.

Environmental Monitoring and Support Lab., Las Vegas, Nev. Monitoring Systems Research and Development Div.

J. C. McFarlane. Available from the National Technical Informa-tion Service, Springfield, Va. 22161, as PB-245 839, 33.50 in paper copy, 52.25 in microfiche. En-vironmental Protection Agency, Report EPA-680/4-75-006, June 1975. 11 p, 2 tab, 21 ref. EPA

Descriptors: \*Tritium, \*Radioisotopes, Radioactivity, Hydroponics, \*Pollutant identification, Plant physiology, Transpiration, Path of pollutants, Alfalfa, \*Radiochemical analysis. Identifiers: Radiochemistry.

Alfalfa plants were hydroponically grown in environmental growth chambers in which they were continuously exposed to tritium. All segments of the environment were in equilibrium with respect to the specific activity of tritium. The tritium content in plant organic matter was about 22 percent lower than in the plant free water or rooting solu-tion. Under conditions of low transpiration, there was a higher concentration (about 1.8) percent of tritium in the leaves than in the stems and rooting solution. This is thought to represent the result of fractionation during transpiration. (EPA)

DEVELOPMENT OF A BIOLOGICAL MONITORING NETWORK - A TEST CASE - SUITABILITY OF LIVESTOCK AND WILDLIFE AS BIOLOGICAL MONITORS FOR ORGANOPHOSPHORUS CONTAMINANTS, Environmental Monitoring and Support Lab., Las

Vegas, Nev. Monitoring Systems Research and

Development Div. W. W. Sutton, and L. L. Salomon.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-246 062, \$4.00 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-680/4-75-003, June 1975. 38 p, 6 fig, 8 tab, 8 ref. EPA F11082, ROAP 22 ACS.

Descriptors: \*Monitoring, \*Bioindicators, Net-works, \*Organophosphorus compounds, \*Utah, Pesticide residues, Analytical techniques, \*Pollutant identification, Cytological studies, Wil-

dife, Livestock, Enzymes.
Identifiers: \*Biological monitoring, Monitoring networks, Animals monitors, Warburg manometric method, Red cells, Erythrocyte acetylcholinesterase.

A review was conducted of a DPG monitoring network which is designed to establish baseline erythrocyte acetylcholinesterase (AChE) levels in the fauna of West Central Utah, and to evaluate the suitability of using livestock and wildlife as biological monitors for organophosphorus con-taminants. Wildlife species sampled during these DPG efforts included the antelope ground squirrel, the ORD Kangaroo rat, the deer mouse, and the black-tailed jackrabbit. Individual blood samples black-tailed jackrabbit. Individual blood samples from cattle and sheep were collected and analyzed for red cell AChE activity. The analytical method employed was based on the Warburg manometric technique. Results indicate that the range of red cell AChE activity values for both livestock and wildlife species is sufficiently compact to allow observation of the depression of enzymic activity that would result from organophosphoras expothat would result from organophosphorus expo-sures. Controlled studies have shown that, follow-ing exposure to organophosphorus chemicals, the red cell activity recovers in an essentially linear fashion. Additive effects resulting from the simultaneous exposure to military agent VX and either toxic plants or commercial pesticides are discussed. (EPA) W76-03633

RADIOCHEMICAL METHODOLOGY FOR DRINKING WATER,

Environmental Monitoring and Support Lab., Cincinnati, Ohio.

H. L. Krieger.

Available from the National Technical Informa-tion Service, Springfield, Va. 22161, as PB-245 406 \$4.50 in paper copy, \$2.25 in microfiche. Environ-mental Protection Agency, Report EPA-600/4-75-008, September 1975. 48 p., 7 fig. 2FH120 (1HA327; POAB 24 AAV, Tack 1985) ROAP 24-AAK; Task 005).

Descriptors: \*Chemical analysis, Methodology, \*Potable water, \*Pollutant identification, Quality control, Measurement, \*Radiochemical analysis, Analytical techniques.

A laboratory manual of radiochemical procedures has been compiled and edited for use in the analysis of specific radionuclides in drinking water; nuclides for whom the Environmental Protection nuclides for whom the Environmental Protection Agency recommended maximum contaminant levels in its interim drinking water standards. In addition to gross activity analyses, the procedures for 134/137Cs, 1311, 226/228Ra, 89/90Sr, 3H and 40K were evaluated by replicate testing to determine the method capabilities and minimum detection levels. The results indicate that the sensitivity of these procedures is at least a factor of ten greater than the present required limits. Appended is information on reagent preparation and suggested sources for purchasing special equipment. (EPA) W76-03635

STUDIES ON VAPORIZATION AND HALOGEN DECOMPOSITION OF METHYL MERCURY COMPOUNDS USING GC WITH A MICROWAVE DETECTOR,

Oak Ridge National Lab., Tenn. Y. Talmi, and R. E. Mesmer.

Water Research, Vol 9, No 5/6, p 547-552, 1975. 4 fig 6 tab 18 ref.

Descriptors: \*Chromatography, \*Mercury, Analytical techniques, Chemical analysis, \*Pollutant identification, Vapor pressure, Distribution patterns, \*Gas chromatography.

Identifiers: \*Methyl mercury, \*Microwave detections.\* tor, \*Distribution coefficients.

Gas chromatography with the sensitive microwave emission spectrometric detector has been used to study the distribution of (CH3)2Hg between air study the distribution of (CH3)2Hg between air and water and the vapor pressures above CH3HgX compounds and their solutions where x designates Cl, Br, I, or OH. The distribution coefficient for (CH3)2Hg is 0.31 at 25 deg C and 0.15 at 0 deg C, which shows that it will be readily lost to the atmosphere above natural waters. Vapor pressures of CH3HgC1 and Ch3HgOH are 11 and 5.6 microns of Hg respectively at 22 deg C. Very rapid photochemical reactions of CH3HgX with 12 or Br2 at very low concentrations were discovered in water at room temperature and this could serve as a means for the destruction of CH3HgX Also, the a means for the destruction of CH3HgX. Also, the reaction with 12 is an important potential source of error in analytical procedures utilizing the high extractability of the CH3HgI species. (Hoyle-Vanderbilt) W76-03638

DETERMINATION OF VOLATILE PHENOLS IN WASTEWATERS OF CHEMICAL PHARMACEUTICAL INDUSTRIES, (IN RUSSIAN),

Vsesoyuznyi Nauchno-Issledouatelskii Institut Vodosnabzheniya, Kanalizatsii, Gidrotekh-nicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii Baku (USSR). Y. Y. Lur'e, M. I. Shemeryankina, and V. G.

Khim-Farm Zh. 8(8): 54-55, 1974.

Descriptors: \*Pollutant identification, \*Phenols, \*Industrial wastes, \*Solvent extractions, Analyti-cal techniques, Chemical analysis. Identifiers: \*Pharmaceutical industry.

#### Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

#### Group 5A-Identification Of Pollutants

To determine volatile phenols in wastewaters of the chemical-pharmaceutical industry the following method is proposed: a sample of the waste-water (10-50 ml depending on the presumed con-tent of phenols) is acidified with 1.5-5 ml of concentrated hydrochloric acid. The solution obtained is extracted with ether (3 times with 15 ml each). All ether extracts are combined ansd washed with 30 ml of a 5% solution of sodium bicarbonate. Then the ether extract is treated with 30 ml of a 5% solution of sodium hydroxide in a 20% solution of sodium chloride. The water layer is removed. The operation of extracting phenols from the ether extract is repeated 3 times. The alkaline aqueous solutions are combined. The volatile phenols are solutions are combined. The votation parents are determined in the mixture obtained with 4-aminoantipyrine by the known method.--Copyright 1975, Biological Abstracts, Inc. W76-03639

EXTRACTION OF METALS BY NEUTRAL SULFUR-CONTAINING EXTRACTANTS, PART O-ISOPROPYL-N-ETHYLTHIOCARBA-MATE.

Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii.

I. V. Seryakova, G. A. Vorobiova, A. V. Glembotsky, and Y. A. Zolotov.

Analytica Chimica Acta, Vol 77, p 183-190, July, 1975. 6 fig, 4 tab, 17 ref.

Descriptors: \*Heavy metals, \*Pollutant identification, \*Separation techniques, Chemistry, \*Solubility, Analytical techniques, Mercury, Copper, Gold, Halides, Radioisotopes, Trace elements, Carbamate pesticides, Organic compounds

Identifiers: Silver, Thallium, Selenium, Distribu-tion coefficients, Thiocarbamates, Flotation reagents.

Results are presented of an investigation of the extraction of many elements by one of the effective flotation reagents and collectors, 0-isopropyl-N ethylthiocarbamate (IPETC). A 0.05 M solution of IPETC in choroform was used to extract solutions of metal nitrates or sulfates labeled with radioactive isotopes. Mineral acids were added before extraction in known amounts. The solutions were mechanically shaken for 5 minutes or longer, the phases were separated, and radioactivity mea-sured in a scintillation counter. The extractions of Cu(I,II), Ag, Au(III), Zn, Cd, Hg(II), Ga, In, Tl(I,III), Bi, MO(VI), W(VI), Se(IV,VI), Te(IV), Fe(III) and Co were investigated in the presence of Cl(-), Br(-), I(-), NO3(-), ClO4(-), and SO4(--) ions The degree of extraction and distribution coeffi-cients are given for the various elements. The effect of acidity on extraction and the time needed for equilibrium is discussed. Results show that by manipulating different halide-sulfuric acid mixwith an IPETC solution in chloroform, the metals may be extracted with high selectivity. (Davis-Vanderbilt) W76-03641

LEAD ISOTOPIC SYSTEMATICS AND AGES OF ARCHAEAN ACID INTRUSIVES IN THE KALGOORLIE-NORSEMAN AREA, WESTERN

AUSTRALIA, Australian National Univ., Canberra. Research School of Physical Sciences. For primary bibliographic entry see Field 2K. W76-03642

HEAVY METAL BINDING COMPONENTS OF RIVER WATER,

Ottawa Univ. (Ontario). Dept. of Biology. S. Ramamoorthy, and D. J. Kushner.

Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1755-1766, 1975. 4 fig, 4 tab, 24 ref.

Descriptors: \*Heavy metals, Chemistry, \*Analytical techniques, \*Chemical properties, Fil-Descriptors:

ters, Particle size, Screens, Ions, Biochemistry, Ionization, Water quality, \*Pollutant identification, Rivers, Canada. Identifiers: \*Binding capacity, Fulvic acid.

Ion-specific electrodes were used to measure the heavy metal (HM) binding capacity of river waters near Ottawa. Binding capacity was measured in unfiltered water and in water passed through filters retaining particles (0.45 micrometers) and macromolecules of molecular weight (MW) 45,000, 16,000, and 1,400. In the most studied water samples, almost all of the Hb2+-binding ability passed through the smallest filter. Filters of different pore sizes retained substantial fractions of the binding ability towards other HM ions. Binding strengths and conditional binding constants were calculated for each HM ion and low MW Ottawa River water components. Binding in Ottawa River water was not due to HCO3- or CO32- ions; in the Rideau Canal, and probably other bodies of water, such ions caused a substantial amount of binding. After complete ashing of Ottawa River water and reconstitution deionized water almost all the HM binding ability was lost; thus, an organic compound(s) is responsible for binding. The binding pattern towards different HM ions of fulvic acid isolated from soil was different from that of unfiltered or filtered Ot-tawa River water. Fulvic acid was not the sole binding component of this water. These experiments suggested a way of assessing the importance of fulvic acid and other humic substances in HM binding by natural waters.(Klein) W76-03651

UPTAKE AND LOSS OF PETROLEUM HYDROCARBONS BY THE MUSSEL, MYTI-LUS EDULIS, IN LABORATORY EXPERI-MENTS.

National Marine Fisheries Service, Seattle, Wash. R. C. Clark, Jr., and J. S. Finley. Fishery Bulletin, Vol 73, No 3, p 518-515, 1975. 8 fig. 1 tab. 20 ref.

Descriptors: \*Mussels, \*Oil spills, \*Organic compounds, \*Absorption, Path of pollutants, Analyti-

pounts, "Absorption, rain of pointains, Analyti-cal techniques, Pollutant identification, Water pol-lution effects, Oil pollution.
Identifiers: "Mytilus edulis, "Petroleum paraffin hydrocarbons, No. 2 fuel oil, No. 5 fuel oil, Elimination, Bioaccumulation, Tissue analysis.

Petroleum paraffin hydrocarbons from No. 2 and No. 5 fuel oils were rapidly incorporated into the mussel, Mytilus edulis, in a laboratory system that simulated tides. The mussels were exposed to levels of petroleum hydrocarbons from a surface slick similar to those encountered in the environ-ment after an oil spill. After 14 days in clean sea-water, the mussels had lost most of the hydrocarbons from the fuel oils; however, detectable traces of the No. 2 fuel oil still remained after 35 days. Preliminary results from these laboratory studies confirmed previous studies of pollutant uptake and loss following actual oil spills. (Klein)

THE DETECTION OF BACILLUS SPORES IN THE CONTEXT OF HYGIEN'C WATER EVALUATION,

R. H. W. Schubert Zentralbl Bakteriol Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Praev Med, 160(2):

Descriptors: \*Pollutant identification, Psendomonas, \*Bacteria, Public health, \*Spores, Nutrient requirements, Bioindicators, Self purification. Water pollution sources, Soils, Ground-Identifiers: \*Bacillus.

Due to their differentiated nutritional require-ments the Bacillus spp. found in large number in the waste matter and the upper layers of the soil

and consequently in the surface water cannot multiply in biotopes of low nutritive content. However, they spread to these areas as spores and are of extraordinary tenacity if not eliminated. In the ground water and within the range of its utilization they are an indicator of the degree of purification or contamination of the water with waste products or surface impurities; their number does not de-pend on the phase of self-purification (e.g., number of colonies) in the sense of the degrada-tion of remaining substances still utilizable by pseudomonads. The concentration of spores of the Bacillus spp. in the surface water ranged from 1000-10,000/50 ml water. In undisturbed ground water 0-5/50 ml were found; in filtered ground water from near the banks and in such water exposed to surface contamination 1000/50 ml or more were found; in the direction of infiltration (proportional to the purification effect in the ground) decreasing numbers of spores of Bacillus spp. were detectable. In areas of subsequent germination of the water supply and water utilization no multiplication of spores of Bacillus spp. was observed, provided no additional contamination occurred.--Copyright 1975, Biological Abstracts, W76-03662

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CURRENT DPD METHODS FOR THE DETER-MINATION OF RESIDUAL HALOGEN COM-POUNDS AND OZONE IN WATER (AKTUALNE METODY DPD DLA ZWYAZKOW CHLOROWEOW I OZONU POZOSTALYCH W

Roczniki Panstwowego Zakladu Higieny, Vol 26, No 4, p 470, 1975.

Descriptors: \*Ozone, \*Halogens, \*Analytical techniques, Chlorine, Water analysis, \*Pollutant \*Halogens, \*Analytical identification Identifiers: \*DPD method.

(N,N-diethyl-p-phenylene-diamine) DPD method of determining the concentration of residual effective chlorine in water has been modified. It permits determination of residual effective chlorine in the presence of CO2 chlorites, bromine, and ozone. The author recently has included glycine (C2H5NO2) which immediately forms chloramine acetate with free chlorine, but does not bind ClO2. In the prescene of KI, monochloracetic acid reacts with DPD. For the titration of iron content, ferro-ammonium sulfate of a known titer added to the sample can activate the chlorites developing as a result of ClO2 reduction. This process interferes with the establish ment of the first end point of titration. In order to prevent this, 0.2 g of disodium edetate is added. For the determination of bromine and broamine in the presence of free chlorine, glycine must be added at the beginning of the analytical procedures in order to bind free chlorine. For ozone determination, excess KI, before or simultaneously with DPD, is added. The addition of glycine during the first phase of the analysis, however, leads to immediate decomposition of ozone which permits determination of effective chlorine after successively adding Ki and DPD to the solution. In the summary, the manner in which special determina-tions are carried out and what reagents have been used were indicated. (Tallert-FIRL) W76-03693

QUALITY CONTROL STARTS AT THE PIPE. Environmental Protection Agency, Kansas City, W. J. Keeffer.

The American City and County, Vol 90, No 10, p 74-75, October, 1975.

Descriptors: \*Monitoring, \*Water quality control, \*Pollutant identification, \*Analytical techniques, Laboratory tests, Sampling, Industrial wastes, Waste water treatment, Chemical analysis, Water analysis, Personnel, Water pollution sources.

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The Environmental Protection Agency has evaluated the need for better effluent sampling techniques, with a greater frequency. As a result of the Water Pollution Control Act Amendments, there has been an increased demand for waste water chemistry data on point source discharges. Present sampling technology uses flow proportional compositing techniques, and the variations in sampler performance and manual sampling in sampler performance and manual sampling techniques mask actual changes in the characteristics of the waste water. Possible sources of error in manual flow compositing or discrete grab samples include: not shaking the discrete sample before compositing, miscalculating correct sample volumes when determining discharge rates from exponential functions based on hydraulic head exponential functions based on hydraulic nead measurements, and misreading of graduated cylin-ders. For industrial waste sampling, it is recom-mended that two compositors (one with discrete sample jars on an hourly cycle, the other taking aliquots at more frequent intervals) be used. Under even ideal circumstances, flow rates cannot be measured more precisely than plus or equal to 10%. Also, the individuals responsible for surveys and sample collection can intentionally or unintentionally manipulate apparent waste water chemistry characteristics. There is a need for more rained and supervised personnel to collect samples and to perform analysis. Adequate monitoring and tight control on sampling techniques, laborato ry procedures and equipment, and data interpreta-tion is urged. (Kramer-FIRL) W76-03694

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VELOCITY GRADIENT CALIBRATION OF JAR-TEST EQUIPMENT, Environmental Sciences and Engineering, Inc.,

Environmental Sciences and Language Gainsville, Fa.
R.J. Lai, H. E. Hudson, and J. E. Singley.
American Water Works Association Journal, Vol 67, No 10, p 553-557, October, 1975. 9 fig, 2 tab, 11

Descriptors: \*Velocity, \*Calibrations, \*Testing procedures, Equipment, Analytical techniques, Mixing, \*Pre-treatment(Water), Turbulence, Stokes law, Impellers, Laboratory tests, Labora tory equipment, Fluid mechanics, \*Pollutant identification.

Identifiers: \*Jar-test equipment, Velocity gadient, Threshold speeds, Drag coefficients.

The jar-test procedure is widely used for calibrating and simulating water pre-treatment processes in the laboratory, but no standard for this procedure exists. The mixing intensities, expressed as the mean gradient, G, for four jar-test configurations were determined throughout the applicable speed range. The fluid condition in plant mixing and flocculation basins is always turbulent and at common jar-test speeds, laminar flow conditions may occur. Minimum threshold speeds required to produce turbulence were deternined. Stokes' theory relates the velocity gradient to the power dissipation function, which can be determined by calculating the torque on the rotor blades. The turbulent gross drag coefficient and butes. The turbell gloss and coefficient can be calculated from G and the speed of the rotors. An alternate approach that was developed used the Reynolds number and the Power number. The force on and the speed of revolution of the rotors were measured in the laboratory. Values for G, the were measured in the laboratory. Values for G, the two drag coefficients, the Reynolds number and the Power number were then calculated. Results from the four configurations studied showed that 6 values depend on the projected areas of the impellers and not on their shape. Variations of the distance of the impellers from the breaker bottoms did not change the energy input. The energy input did increase with the addition of baffles, but it was the same regardless of baffle size or geometry with agiven impeller. The minimum threshold speed for highly leading the same regardless for the first possible size or geometry with agiven impeller. The minimum threshold speed for urbulence was 100 rpm for unbaffled systems and 0.50 rpm with baffled systems. (Pinto-FIRL) W76-03695

AUTOMATIC SEWER SAMPLING SYSTEM MONITORS FOR SPILLS, Union Carbide Corp., Chicago, Ill.

J. F. Galluzzo.

Pollution Engineering, Vol 7, No 9, p 73, September, 1975, 1 fig.

Descriptors: \*Water quality control, \*Water pollution, \*Industrial wastes, \*Spills, Monitoring equipment. \*Pollutant identification.

An automatic sampling and monitoring system is described which can be installed in plant sewers to detect any accidential spills or abnormal discharges in a production plant. The monitoring system can be used to monitor sewers which carry storm water, surface run-off water, or cooling water. The pH, conductivity, and total organic car-bon are reported for each stream. Specially designed floats are suspended in the flowing streams of the sewers which draw off a uniform continuous sample. The sample is pumped by selfpriming pumps into flow-through type pH and conductivity sensors and into a total carbon analyzer. The flow-through sensors for pH and conductivity are cleaned periodically by ultrasonic cleaners. The water sample to the carbon analyzer is filtered; the filter is cleaned as needed. High and low alarms are provided for pH. High alarms are provided for conductivity and total carbon. When a alarm is activated, a grab sample of the abnormal stream is activated, a grao sample of the annormal stream is taken immediately. The sample is then analyzed to determine the specific pollutant present. The system permits closer control of un-planned spills and discharges. (Orr-FIRL) W76-03696

PERFORMANCE OF AUTOMATIC WASTE-WATER COMPOSITIONS, Environmental Protection Agency, Region VII,

Kansas City, Missouri.

D. J. Harris, and W. J. Keefer.
In: Proceedings of the 29th Industrial Waste Conference, May 7-9, 1974, Purdue University, Lafayette, Indiana, p 213-222. 7 tab, 1 ref.

Descriptors: \*Sampling, \*Data collections, \*Water quality, Equipment, \*Automation, \*Waste water treatment, Treatment facilities, Monitoring, Analytical techniques, Chemical analysis, Water analysis, Sewage treatment, Pollutant identification. Measurement.

Identifiers: Water quality samplers, Water quality

Discrepancies in water quality data have been noted which appeared to result from variations in automatic waste water sampling equipment per-formance. Four studies were conducted to compare the water chemistry data of samples collected concurrently with various makes and models of commercially available samplers. Analysis were performed on samples from the Richards-Gebaur AFB, the Thersea Street Sewage Treatment Plant in Lincoln, Nebraska, the Ashland, Nebraska, Sewage Treatment Plant, and the KAW Point Sewage Treatment Plant in Kansas City, Kansas. Each comparison indicated significant raw waste data discrepancies resulting from differences in performance of sampling equipment or manual techniques. The implication is that waste water chemistry characteristics and facility removal effectiveness can be manipulated intentionally or unintentionally by selection of sampling equip-ment. High-vacuum samplers produced more representative samples and should be used on raw municipal waste waters or wastes with significant levels of heavy suspended material. Current sampling methodologies and equipment must be refined to improve data reproducibility and accuracy. (Kramer-FIRL)

FORMATION OF ORGANOCHLORINE COM-POUNDS FROM THE CHLORINATION OF A MUNICIPAL SECONDARY EFFLUENT, North Texas State Univ., Denton. Inst. for Environmental Studies For primary bibliographic entry see Field 5D. W76-03699

OXYGEN DEMAND PARAMETERS: COR-RELATION OF BOD5 WITH COD, Sangamon State Univ., Springfield, Ill. K. G. Janardan, and D. Schaeffer. Water and Sewage Works, Vol 122, No 10, p 62-65, October, 1975. 8 fig. 3 tab, 11 ref.

Descriptors: \*Biochemical oxygen demand, \*Chemical oxygen demand, Statistics, Analytical techniques, Laboratory tests, Correlation analysis, Statistical methods, \*Oxygen demand, \*Pollutant identification.

Identifiers: Correlation coefficient, BOD5.

Examinations of stream and effluent BOD5 and COD measurements have indicated that monitoring for COD can replace measurements for routine screening. It is necessary to test for BOD5 only if the sample COD exceeds a specified maximum. Statistical analyses were performed on 113 stream samples and 713 effluent samples gathered in Il-linois Environmental Protection Agency laborato-ries from January 1971 to December 1972. A statistical correlation was established between COD and BOD5. The regression coefficients are not a technique for calculating BOD5 values from COD data. The establishment of the correlation permits the substitution for BOD5 by COD after corresponding control limits for COD are detercorresponding control limits for COD are determined at a chosen level of probability. If the COD value exceeds the chosen limit, then a BOD5 test should be performed because the legal limits are based on BOD5. (Orr-FIRL)

DETERMINATION OF AMMONIA-, NITRATE-, AND ORGANIC NITROGEN IN WATER AND WASTE WATER WITH AN AMMONIA GAS-SENSING ELECTRODE,

Invercargill Southland Regional Water Board

(New Zealand). L. R. McKenzie, and P. N. W. Young. The Analyst, Vol 100, No 1194, p 620-628, Sep-tember, 1975. 7 tab, 10 ref.

Descriptors: \*Nitrogen, \*Pollutant identification, \*Water analysis, Ammonium compounds, Elec-trodes, Ion exchange, Measurement, Sampling, Organic compounds, Water pollution, Water quali-ty, Waste water treatment.

Identifiers: Ammonium ion selective electrode, Ammonia-nitrogen, Nitrate-nitrogen, Organic

An Orion ammonium ion selective electrode has been used for the determination of ammonianitrogen, nitrate-nitrogen, and organic nitrogen on both waters and effluents. Nitrate-nitrogen could be measured as ammonia-nitrogen after reduction in acid conditions, with the use of an alkali of higher concentration than normal to achieve a pH of 12. A simple method for reducing nitratenitrogen to ammonia-nitrogen was employed, with nascent hydrogen produced in situ by the action of acid on Devarda's alloy. It was found that the presence of metals producing insoluble hydroxides when the alkali pH adjuster was added to the sam-ple interferred with the permeability of the membrane and affected the response time of the electrode. However, this interference could be avoided with the use of EDTA in large amounts. By using 1.0 M EDTA as a complexing agent, the measurement of ammonia-nitrogen compounds in sea water was simplified. The ammonia electrode was also used to determine organic nitrogen in waste water and water samples. The electrode does not produce any improvements over a conventional method. However, because organic

#### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

#### Group 5A-Identification Of Pollutants

nitrogen may be determined in conjunction with ammonia- and nitrage-nitrogen in the same sample, the advantage lies in using a single measuring technique for the three types of compounds. (Kramer-FIRL) W76-03702

SIMPLIFIED PHOSPHORUS ANALYSIS TECHNIQUE,

Wisconsin Univ., Madison. Water Chemistry Lab. S. J. Eisenreich, R. T. Bannerman, and D. E.

Armstrong. Environmental Letters, Vol 9, No 1, p 43-53, 1975. 1 fig. 3 tab. 10 ref.

Descriptors: \*Phosphorus, \*Chemical analysis, \*Pollutant identification, Digestion, Oxidation, Absorption, Analytical techniques. Identifiers: Total phosphorus, Total dissolved phosphorus, Dissolved reactive phosphorus,

phosphorus, Dis Molybdenum blue.

Common techniques for the determination of total phosphorus (TP) and total dissolved phosphorus (TDP) depend on a digestive or oxidative procedure followed by a type of molybdenum blue procedure. These techniques are complicated and time consuming. A simplified and more sensitive procedure has been developed to determine TP, TDP and the dissolved reactive phosphorus (DRP). The neutralization, transfer and dilution steps needed in the other procedure are eliminated. A single digestive reagent and a single mixed reagent for color formation are required.

The absorbance of the resultant solution is measured at 882 nm. It is also possible to measure the absorbance at a secondary peak at 710 nm with a 30% reduction in sensitivity, if the higher wavelength is not available. This method results in a 70% decrease in analysis time, a decrease in the amount of glassware needed and a 30% increase in sensitivity. It can be applied to samples containing phosphorus in the range of 2 to 1000 micrograms P/liter and can be extended by a factor of five by using sample aliquots of as little as 5 ml. Centrifugation of samples containing large quantities of suspended matter following digestion is recommended. (Pinto-FIRL) W76-03705

A MODIFIED PROCEDURE FOR THE DETERMINATION OF NITRATE IN SEDIMENTS AND SOME NATURAL WATERS,

Canada Centre for Inland Waters, Burlington (Ontario).

B. K. Afghan, and J. F. Ryan. Environmental Letters, Vol 9, No 1, p 59-73, 1975. 3 fig. 2 tab. 12 ref.

Descriptors: \*Nitrate, \*Sediments, \*Natural streams, Chemical analysis, Colorimetry, Chemical precipitation, Acidity, \*Pollutant identifica-Waste water(Pollution), Humic acids, Analytical techniques.
Identifiers: Shipek bucket sampler

It has been found that existing methods for determining nitrate in sediments and some natural waters do not give precise and accurate results due to the presence of sulfide and high concentrations of humic acid substances. A procedure for the removal of these substances prior to nitrate analysis by a colorimetric method is described. The sulfide in the acidic medium is first removed by copper and the humic acid - copper complexes are precipitated by neutralizing the pH of the solution. Sediment samples were collected by a Shipek bucket sampler, freeze dried to remove water, ground to fine particles and stored. The sulfide and the humic acid were removed by the successive addition of copper sulfate to precipitate the sulfide and potassium hydroxide to neutralize the solution precipitate the copper and humic acid Colorimetric analysis was then performed on the resulting solution to determine nitrate concentration. Samples were spiked with known amounts of nitrate to test the procedure and results were consistently near the 100% recovery level compared to low recovery levels for samples not treated. Detailed analyses, conducted to determine what substances in waste water interfered with the process and therefore had to be removed, showed that calcium, iron, manganese and sulfide ions in addition to humic acid interfered. The procedure has been tested on a wide variety of natural water samples, sediments, clays and sands. (Pinto-FIRL) W76-03706

ANALYSIS FOR AQUEOUS NITRATES AND NITRITES AND GASEOUS OXIDES OF NITROGEN BY ELECTRON CAPTURE GAS CHROMATOGRAPHY,

Monsanto Research Corp., Dayton, Ohio, Dayton

W. D. Ross, G. W. Buttler, T. G. Duffy, W. R. Rehg, and M. T. Wininger.

Journal of Chromatography, Vol 112, p 719-727, October, 1975. 3 fig, 2 tab, 7 ref.

Descriptors: \*Nitrates, \*Nitrites, \*Nitrogen, \*Gas chromatography, \*Chemical analysis, \*Pollutant identification, Aromatic compounds, Nitrogen compounds, Calibrations, Solubility, Urine, Potable water, Instrumentation.

\*Electron capture Nitrobenzene, Nitration,

Because of the toxicity and reactivity of nitrogen oxide gases and aqueous soluble nitrites and nitrates, analysis methods are of great concern. A gas chromatographic method of analysis based on the nitration of an aromatic compound is described. If benzene is used in combination with sulfuric acid, potassium nitrate, potassium nitrite or nitric acid as reagents, nitrobenzene will be produced. The advantages of this process are: nitrobenzene is relatively stable and can be stored before sampling; many different species of nitrogen based compounds can be analyzed using the same apparatus and almost the same analysis nitrobenzene can be detected with great sensitivity with an electron capture detector (ECD); and only very small samples are needed beacuse of the great sensitivity. Analyses were conducted to determine the reactivity of benzene with nitrate, and the GC properties of nitrobenzene. The chromatograms were found to be relatively free of interfering peaks, indicating that the samples were of high purity. Solubility studies showed that nitrobenzene separated between two layers of benzene and sulfuric acid. This is a necessary consideration in the calibration procedures, of which three were developed. Tests performed on efficiencies of conversion showed that potassium nitrate gives the highest efficiency, nitric acid the next highest and potassium nitrite the lowest efficiency. Tests were also made to determine the concentrations of nitrates in human urine and drinking water from a city water supply. (Pinto-FIRL) W76-03707

TRACE ANALYSIS OF ORGANIC VOLATILES IN WATER BY GAS CHROMATOGRAPHY-MASS SPECTROMETRY WITH GLASS CAPIL-LARY COLUMNS,

Alabama Univ., University. Dept. of Chemistry. W. Bertsch, E. Anderson, and G. Holzer. Journal of Chromatography, Vol 112, p 701-718, October, 1975. 4 fig, 4 tab, 70 ref.

Descriptors: \*Volatility, \*Organic compounds, chromatography, \*Mass spectrometry, tical techniques, Chemical analysis, Analytical techniques, Chemical analysis, Pollutant identification, Gases, Organic compounds, Potable water, Waste water(Pollution), Adsorption, Aromatic compounds, Industrial wastes, Water treatment.

Identifiers: \*Gas capillary columns, Halogenated hydrocarbons, Gas-Phase stripping, Desorption.

The increasing use of water from polluted sources for drinking purposes has made it necessary to monitor that water from all aspects. Halogenated hydrocarbons have recently been found in drink-ing waters. A short review of current sampling procedures and some of the options are discussed. Processes that have been applied in the past include liquid-solid adsorption, batchwise and continuous liquid-liquid extraction, freeze-drying, distillation, vacuum evaporation, gas-phase stripping and reverse electroosmosis. There are many factors present which can intorduct syste-matic errors into these systems. The alternate method described is based on gas-phase stripping. Organic substances which partition in the gas phase are continuously removed from the water. They are concentrated and adsorbed onto a porous polymer. Seaprations were carried out by using highly efficient glass capillary columns. The sample is transferred into a gas chromatographic column by a process using heat desorption. The capacity of the adsorbent was determined for a number of model substances found in water. Compounds less volatile than benzene were usually retained, with some exceptions. Samples studied included both tap water and untreated waters. High incidences of halogenated hydrocarbons were found in drinking water but not in industrial or stream waters, supporting the hypothesis that they are introduced in the water treatment process. Samples from a recreational lake showed high concentrations of volatiles. Samples from industrial waters showed camphor related substances and terpene derivatives. (Pinto-FIRL) W76-03708

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STUDIES ON ANION ACTIVE SURFACTANTS.
I. DETERMINATION OF ANION ACTIVE SURFACTANTS IN NATURAL AND WASTE WATERS USING CLEANUP BY XAD 2 COLUMN CHROMATOGRAPHY (IN ION KAIMEN KASSERZAI NI KANSURU KENKYU (DAI 1 PO) ),

R. Takeshita, and H. Yoshida. Eisei Kagaku, (The Journal of Hygienic Chemistry), Vol 21, No 4, p 209-215, 1975. 1 fig, 4 tab.

Descriptors: \*Surfactants, \*Water analysis, Analytical techniques, \*Pollutant identification, Colorimetry, Ion exchange.
Identifiers: Anion-active surfactants, Methylene Blue method.

Anion-active surfactants, both in natural waters and waste waters, may be determined by a reliable method. The method consists of cleanup on an amberlite XAD2 column and determination by colorimetry using Methylene Blue. A sample may be directly passed through the column; the column is then washed with 0.05 N sodium hydroxide solution. Surfactants taken up by the resin are eluted with a mixture of acetone and aqueous ammonia. The acetone is then evaporated from the effluent and the surfactants are determined as sodium 4-(2-dodecyl)benzenesulfonate by the Methylene Blue method. Even when surfactants are contained at very low levels, they may be concentrated and measured by loading a large amount of the sample over the column. The average recovery of sodium 4-(2-dodecyl)benzenesulfonate from water for-tified at levels of 50 and 100 micrograms was 100.5%. (Kramer-FIRL) W76-03710

ANALYTICAL METHODS FOR ORGANIC COMPOUNDS IN SEWAGE EFFLUENTS. Pollution Research Lab., Stevenage (England).

Notes on Water Pollution, No 70, September, 1975. 1 fig, 4 tab, 32 ref.

Descriptors: \*Analytical techniques, \*Organic compounds, \*Sewage effluents, Sewage, Ef-fluents, \*Pollutant identification, Sewage treat-ment, Waste water treatment, Gas chromatography, Mass spectrometry, Infrared radiation,

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Identification Of Pollutants-Group 5A

Volatility, Computers, Freeze drying, Vacuum drying, Resins, Instrumentation.
Identifiers: Gas-liquid chromatography, Highpressure liquid chromatography, Infrared spectroscopy, Thermionic detectors, Microwaveplasma detectors, Electron capture detectors, Head-space analysis, Liquid-liquid extraction, Steam distillation, Foam concentration.

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Certain quantities of organic matter are resistant to biodegradation due to conventional treatment processes. Broad characterizations of sewage ef-fluents are useful in pointing toward the type of detailed analysis that is necessary. Sensitive analytical techniques for detection of organic matter in effluents are discussed. The organic constituents of an effluent must first be concentrated matter in effluents are discussed. The organic constituents of an effluent must first be concentrated into a small volume so that they fall within the limits of sensitivity of the detection apparatus. Newer methods being used include head-space analysis, liquid-liquid extraction, freeze drying followed by liquid-solid extraction, vacuum evaporation, steam distillation, foam concentration and concentration by synthetic resins. Two methods of separation are gas-liquid chromatography (GLC) and high-pressure liquid chromatography (HPLC). GLC is useful for separating volatile substances, which make up 30 to 40% of the organic carbon present in sewage effluent. Detectors developed for GLC analysis include electron-capture detectors, thermionic detectors and microwave-plasma detectors. HPLC can be used for the remaining 60 to 70% of the organic matter that is non-volatile. However, it has not reached the same stage of advanced development as has GLC and there are no comparable detectors. Two characterization techniques used are infrared (IR) spectroscopy and mass spectroscopy (MS). Both characterization techniques used are infrared (IR) spectroscopy and mass spectroscopy (MS). Both of these techniques can be coupled with GLC systems, providing rapid accumulation of vast quantities of spectral data. GLC and MS can also be combined with computer systems as can other instrumental analytic methods. (Pinto-FIRL) W76-03711

AGRICULTURAL RUNOFF POLLUTES SURFACE WATERS, PART I,
South Dakota State Univ., Brookings. Dept. of

Civil Engineerig. L. L. Harms, P. Middaugh, J. N. Dornbush, and J.

R. Andersen. Water and Sewage Works, Vol 122, No 10, p 84-85, October, 1975. 2 tab.

Descriptors: \*Water pollution sources, \*Pollutant identification, \*Coliforms, Agricultural runoff, Bacteria, Sampling, Data collection. Identifiers: Fecal coliforms, Fecal streptococci,

Nonpoint sources.

Nonpoint sources of water pollution from urban areas, agricultural lands, forests, and grazing areas have been recognized. In this study, data were presented pertaining to surface runoff from agricultural land. Information was collected on the densities of bacteriological indicator organisms found in the runoff and how these densities related to water quality criteria for the receiving waters. A lifield conditions were natural and uncontrolled. The most common bacteriological test for water and waste water samples is total coliform. However, because these organisms may result from and waste water samples is total coliform. How-ever, because these organisms may result from agricultiral matter such as grains or plants, other indicators, fecal coliform (FC) and fecal streptoc-occus (FS), were used. A FC/FS ratio has been used to determine whether pollution in a water sample is used from human or animal sources. Data were collected from seven sites in eastern South Dakota on surface runoff from snowmelt and rainfall. Flow measuring equipment, water level recorders, and automatic samplers were used at each site. Composite samples were made from the discrete samples that had been automatically collected. These were stored at 4 C and tests were performed about 12 hours after initial collection by the sampler. Results of the tests are evaluated in the second part of this article. (Kramer-FIRL)

CONTRIBUTIONS TO THE CHEMISTRY OF ANTARCTIC SNOW: DETERMINATION OF TRACE ELEMENTS AT THE PPB LEVEL BY ATOMIC ABSORPTION SPECTROMETRY, Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire de Glaciologie. For primary bibliographic entry see Field 2C. W76-03728

CONTRIBUTION TO THE CHEMISTRY OF AN-TARCTIC SNOW: TRACE ELEMENT DOSAGE BY NEUTRON ACTIVATION, Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire de Glaciologie. For primary bibliographic entry see Field 2C. W76-03729

QUALITY VARIATIONS OF THE MEKONG RIVER AT PHNOM PENH, CAMBODIA, AND CHEMICAL TRANSPORT IN THE MEKONG

Universite Pierre et Marie Curie, Paris (France), CNRS, Laboratoire de Geologie Dynamique. J. P. Carbonnel, and M. Meybeck. Journal of Hydrology, Vol 27, No 3/4, p 249-265, December 1975. 5 fig. 6 tab, 17 ref.

Descriptors: \*Water quality, River basins, \*Dissolved oxygen, \*Temperature, \*Hydrogen ion concentration, \*Conductivity, \*Ions, \*Asia, Discharge(Water), Sediment transport, Chemical properties, Sampling, Variability, Dissolved solids, \*Pollutant identification.

Identifiers: \*Mekong River(Cambodia), Phnom Penh(Cambodia), Southeast Asia.

Daily samples were collected between January 1961 and December 1962, and pH, temperature, 1961 and December 1962, and pH, temperature, dissolved oxygen and conductivity were measured. Monthly analyses of water quality were conducted, and the results were (in mg/l): SiO2, 8.85; Ca(2+), 14.2; Mg(2+), 3.2; Na(+), 3.6; K(+), 2.0; Cl(-), 10.5; SO4(2-), 3.8; HCO3(-), 57.9; NO3(-), 1.1. The chemical quality of Mekong waters was found highly variable (total ionic content ranged from 60 to 190 mg/l). As usual, concentrations C decrease with increasing displayers O according to from 60 to 190 mg/l). As usual, concentrations C decrease with increasing discharge Q according to the relation C=aQ to the bo power, with -1 less than b less than 0. To this general trend are superimposed secondary cycles, due to the Annamitic tributaries, that are responsible for important scatterings of concentrations. These processes can only be stuided day by day, but 12-18 analyses per year seemed to be sufficient to compute reliable weighted means. The total mineral transport to the occan was estimated to 59,500,000 t/year. It appeared that mineral dissolved matter transported by the Mekong riveoriginates mainly from the lower basin. This region originates mainly from the lower basin. This region has an average dissolved transport of 75t/sq km/year in spite of its mid-altitude relief. If this value is taken as an average for Southeast Asia (10,000,000 sq km), this region could contribute up to 30% of the world dissolved input to the ocean. (Lardner-ISWS) W76-03745

A COMPARATIVE EVALUATION OF THE WEISS SATUROMETER, Battelle Pacific Northwest Labs., Richland, Wash.

Ecosystems Dept.
D. H. Fickeisen, M. J. Schneider, and J. C.

Montgomery.
Transactions of the American Fisheries Society, No 4, p 816-820, 1975. 2 fig, 2 tab, 6 ref.

Descriptors: \*Methodology, Design, \*Gas chromatography, \*Instrumentation, \*Analytical techniques, Saturation, Gases, Pressure, Comparative productivity, Laboratory tests, \*Pollutant identification.

Identifiers: \*Saturometer, \*Weiss saturometer, \*Dissolved gas.

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The Weiss saturometer, an instrument which measures dissolved gas tensions, was evaluated and compared with gas chromatographic apparatus. With vigorous shaking the saturometer equilibrated with dissolved gas tension after fifteen to twenty-five minutes in moderately superteen to twenty-five minutes in moderately super-saturated water. Both methods (gas chromatog-raphy and the Weiss saturometer) appeared to offer advantages in specific applications, and the method of choice for dissolved gas analysis remained dependent on individual requirements. The need for conscientious operation of the saturometer by an experienced operator was apparent. (Klein)

TOTAL POPULATION DENSITY OF CRUSTACEA AND AQUATIC INSECTA AS AN INDICATOR OF FENTHION POPULATION OF RIVER WATER, Plant Protection Research Inst., Pretoria (South

For primary bibliographic entry see Field 5G. W76-03779

IDENTIFICATION AND POTENTIAL BIOLOGI-CAL EFFECTS OF THE MAJOR COM-PONENTS IN THE SEAWATER EXTRACT OF

A BUNKER FUEL, California Univ., Berkeley. School of Public

HE. G. Guard, L. Hunter, and L. H. Di Salvo.
Bulletin of Environmental Contamination and
Toxicology, Vol 14, No 4, p 395-401, 1975. 1 tab, 1
fig, 7 ref.

Descriptors: Water pollution sources, Laboratory tests, Analytical techniques, Methodology, \*Water pollution effects, Environmental effects, \*Separation techniques, \*Crabs, Commercial shellfish, Fuels, \*Oil pollution, Oil, Water pollution, Solubility, Organic compounds, Phenols, Chromatography, Spectroscopy, \*Pollutant Chromatography, Spectroscopy, identification, \*California, Bays. Identifiers: Pachygrapsus crassipes, \*San Francisco Bay(Calif), \*Bunker fuel.

The composition of the seawater extract of a bunker fuel, methodology for obtaining the sea-water-soluble fraction of bunker fuels and sigwater-soluble fraction of bunker fuels and significance of the dissolved oil to a crab species are reported. Major water-soluble components were identified as acetophenone, 2-phenyl-2-propanol, phenol and cresols. This investigation was designed to simulate an oil spill of bunker fuel in San Francisco Bay in January, 1971. The shore crab (Pachygrapsus crassipes) population in and around San Francisco Bay was decimated. It was suggested that this was due to an adverse effect of the water-soluble components on this and other the water-soluble components on this and other commercially important crabs. (Katz) W76-03781

V-NOTCH WEIR AIDS IN METERING TREATED EFFLUENTS, Clontz (J.R.) Associates, Tampa, Fla.

J. M. Clontz. Water and Sewage Works, Vol 122, No 10, p 86-87, October, 1975. 2 fig.

Descriptors: \*Flow measurement, \*Weirs, \*Effluents, \*Sewage treatment, \*Waste water treatment, Treatment facilities, Sewers, Equipment, Monitoring, Water pollution control, Waste treatment, Waste disposal, \*Pollutant identification, Rural areas.

Identifiers: V-notch weirs.

V-notch weirs have been used to meter effluents from small on-site waste treatment plants in developing rural areas. In Broward County, Florida, such treatment facilities are being replaced with sewers. At present, however, many small treatment plants are located unobtrusively on private properties. In this county, polluters are

#### **Group 5A—Identification Of Pollutants**

liable for a civil penalty of up to \$5000 per day. Thus, an accurate measure of effluent flow from Inus, an accurate measure of effluent flow measuring system was developed by the American Meter Division of the Singer Company. The system provides a daily chart record of flow in gallons per hour, with indication of variations in the flow rates and a cumulative digital read-out of total effluent volume. Thus, periodic readings show total flow per day or week. The measurement is made by an open channel v-notch weir, in-cluding a recorder. Installations of the weir and recorder are illustrated. When flow rates exceed the range of the v-notch weir app.lication, other equipment such as rectangular weirs. Parshall flumes, and Palmer-Bowlus flumes may be substituted. (Kramer-FIRL) W76-03790

'THAMESWATER' HELPS IN THE FIGHT FOR A CLEANER RIVER, C. Dover.

Surveyor, Vol 146, No 4345, p 12, September 19,

Descriptors: \*Water quality control, \*Rivers, \*Aquatic life, Sludge disposal, \*Pollutant identification, Dissolved oxygen, Powerplants, Water temperature, Alkalinity.
Identifiers: \*Thames River(G.B.), Water authori-

The Thames Water Authority has commissioned a new research vessel to monitor the Thames River water quality. Called the 'Thameswater', this launch will observe the effect that the five sludge disposing vessels are having on the river. In the past year it has been found that the Thames is related to the past year it has been found that the Thames is related to the past year it has been found that the Thames is related to the past year it has been found that the Thames is related to the past year. tively clean and that fears that it may become anaerobic are unnecessary. The typical pattern of dissolved oxygen for the river is high a Richmond, declining to a minimum at Crossness and rising to almost fully saturated at Southend. It was also found that the Thames has been on the average two degrees cooler than in past years probably due to a reduction in electricity con-sumption and thus a lower load of heat pollution from power stations. The 'Thameswater' is used by teams from the Thames Water Authority chemical laboratories and biological research facilities. It can automatically monitor the river temperature, its chloride content (for salinity), and alkalinity and ammonia and nitrate levels. An abundance of aquatic life and clean seaweeds have indicated that the river is generally healthy.
(Kramer-FIRL)

NITRATES IN WISCONSIN GROUND WATER, Wisconsin State Lab. of Hygiene, Madison For primary bibliographic entry see Field 5B.

ORGANICS IN DRINKING WATER, PART I-LISTING OF IDENTIFIED CHEMICALS,

Ames Lab., Iowa. G. A. Junk, and S. E. Stanley. Report No IS-3671, July, 1975. 84 p, 1 tab, 94 ref,

Descriptors: \*Potable water, \*Organic compounds, \*Pollutant identification, Water supply, Public health, Water analysis, Reviews, Water

A tabulation of the organic chemicals which have been identified in potable water and in other water which might be used as raw water sources for public drinking water is presented. The compilation was prepared by reviewing all available re-ports of organics in water. The table is an alphabetical listing of 423 organic chemicals of which 325 have been reported in drinking waters, and 394 have been specifically identified. Molecu-lar weights, empirical formulas, structural infor-

mation and literature citations are also given. The identified organic contaminants in drinking water are usually present at less than 10 micrograms/liter (10 ppB). Most of the identified organic chemicals boiling points above 150C are present in drinking water at concentrations less than one microgram/liter (one ppB). (Orr-FIRL) W76-03850

APPENDIX 7, WATER QUALITY, GREAT LAKES BASIN FRAMEWORK STUDY.
Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. 1975. 228 p, 40 fig, 78 tab, 32 ref.

Descriptors: \*Great Lakes Region, \*Water quali-Ty, "Administrative agencies, "Illinois, "Indiana, "Michigan, "Minnesota, "New York, "Ohio, "Pennsylvania, "Wisconsin, "Lake Superior, "Lake Michigan, "Lake Huron, "Lake Erie, "Lake Ontario, Water quality standards, Water pollution sources, Data collections, River basins, Regulation, Water pollution control, Waste water treatment, Federal government, State govern-ments, Treatment facilities, Construction costs, Water quality control.

Many Federal, State, and local programs exist for the purpose of maintaining or enhancing water quality in the Great Lakes Basin, Principal Federal programs include those relating to comprehensive programs, technical assistance, grant programs, enforcement, Federal installations, Refuse Act permit programs, water hygiene, environmental impacts, pesticide programs, radiation programs, research, and monitoring. Interstate water quality standards have been adopted by all Great Lakes Basin States, but many water quality problems of varying degrees of severity exist in all of the Lake basins. A substantial part of the wastewater treatment needs and the resultant investments will occur during the 1970 to 1980 period, and many of the investment requirements occur in the planning subareas or river basin groups containing large population concentrations or industry. In addition municipal and industrial wastewater control problems, other existing and potential problems problems, other existing and potential problems involve wastes from watercraft, runoff from urban and rural land, including residues from application of chemicals, fertilizers and pesticides, thermal pollution, and disposal of dredged materials. The report summarizes water quality conditions and trends in relation to established water use designations and potential future uses. It also identifies the nature, location, and gravity of water quality problems, and defines actions needed to maintain or improve the quality of the waters of the Basin. Also found in the report are general cost estimates for carrying out major components of the required action program. (Humphreys-ISWS) W76-03864

STREAM QUALITY IN RELATION TO MINE DRAINAGE IN COLORADO, Geological Survey, Denver, Colo. For primary bibliographic entry see Field 5B.

W76-03900

THERMODYNAMIC CONSTRAINTS ON METAL SOLUBILITIES IN A STREAM AFFECTED BY MINE DRAINAGE, BONANZA, COLORADO,

Geological Survey, Denver, Colo. For primary bibliographic entry see Field 5B.

EVALUATION AND PROPOSED STUDY OF POTENTIAL GROUND-WATER SUPPLIES, GALLUP AREA, NEW MEXICO, Geological Survey, Albuquerque, N. Mex. For primary bibliographic entry see Field 4B.

HYDROLOGY OF MALHEUR LAKE, HARNEY COUNTY, SOUTHEASTERN OREGON, Geological Survey, Portland, Oreg. For primary bibliographic entry see Field 4A. W76-03906

WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1975. Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 7C. W76-03907

HARFORD COUNTY GROUND-WATER IN. FORMATION: WELL RECORDS, CHEMICAL QUALITY DATA, AND PUMPAGE, Geological Survey, Parkville, Md. For primary bibliographic entry see Field 7C. W76-03912

WATER QUALITY IN RHODE RIVER AT SMITHSONIAN INSTITUTION PIER NEAR AN-NAPOLIS. MARYLAND. APRIL THROUGH DECEMBER 1973,

Geological Survey, Edgewater, Md. Chesapeake Bay Center R. L. Cory, J. M. Redding, and M. M. McCullough.

Available from the National Technical Informa-tion Service, Springfield, Va 22161, as PB-246 723, \$4.50 in paper copy, \$2.25 in microfiche. Water-Resources Investigations 10-74, January 1975. 67 p, 7 fig, 1 tab

Descriptors: \*Water quality, \*Rivers, \*Maryland, \*Estuaries, \*Water properties, Chemical analysis, Data collections, Water temperature, Salinity, Turbidity, Dissolved oxygen, Hydrogen ion concentration, Water levels, Tidal effects. Identifiers: \*Rhode River estuary(Md).

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Water temperature, salinity, turbidity, dissolved oxygen, pH and water level data were continu-ously monitored at the Smithsonian Institution's pier Rhode River, Md. Data consist of graphs of daily maximum and minimum values summarized by week to give weekly averages and extremes and a table which gives daily maxima and minima. Temperatures showed an overall range from 0.7 to 32.6 deg C. The water temperature data indicate successively warmer winters. Salinity ranged from 1.05 to 14.03 parts per thousand. In June 1972, salinity dropped markedly as fresh water from tropical storm Agnes entered the Rhode River from the Susquehanna River via the Cheseapeake Bay. Turbidity was usually low, averaging about 14 Jackson Turbidity Units; however during spring and early summer of 1972, values averaged about 23 Jackson Turbidity Units. This increase in tubidity was due to the high Susquehanna River flows during that period. Extremes of turbidity ranged from about 5 to 80 Jackson Turbidity Units. Dissolved oxygen ranged from 0.0 to 19.8 milli-grams per litre. Large daily chapges in oxygen indicated a high state of biological metabolism. Values of pH ranged from 6.8 to 10.1 and daily changes coincided with oxygen changes. Tide dominated water levels had an overall range 5.9 ft (1.8 metres) and a mean tidal range of 1.5 ft (0.46 metres). (Woodard-USGS) W76-03914

METHODS FOR COLLECTION AND ANALYSIS OF AQUATIC BIOLOGICAL AND MICROBIOLOGICAL SAMPLES,

Geological Survey, Menlo Park, Calif. K. V. Slack, R. C. Averett, P. E. Greeson, and R. G. Lipscomb.

Available from Supt. of Documents, GPO, Washington, D.C., 20402, Price \$2.85. Techniques of Water-Resources Investigations, B. Chapter A4, 1973. 165 p, 29 fig, 2 tab, 6 ref.

Descriptors: \*Water sampling, \*Water analysis, \*Methodology, \*Biological properties, \*Microbiology, Sampling, Preservation, Analytical techniques, \*Pollutant identification.

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The U.S. Geological Survey series of manuals on techniques describes procedures for planning and techniques describes procedures for planning and executing specialized work in water-resource investigations. Chapter A4 of Book 5 contains methods used by the U.S. Geological Survey to collect, preserve, and analyze waters for their biological and microbiological properties. Among biological and microorlogical properties. Among the topics discussed in Part 1 are aquatic habitats and communities, biological sampling and sampling statistics, and use of the microscope. The statistical procedures are accompanied by examples. Part 2 consists of description of 30 individual ples. Part 2 consists of description of 30 individual methods, including those for bacteria, seston, chlorophyll, diatoms, phytoplankton, zooplankton, periphyton, primary productivity, macrophytes, benthic invertebrates and fish and other aquatic vertebrates. Each method is summarized, and the application, interferences, apparatus, reagents, collection, analysis, calculations, reporting of results, precision, and references are given. Part 3 consists of a glossary. (Woodard-USGS) W76.03015 W76-03915

PHENOLIC ACIDS AS INDICATORS OF POL-LUTION WITH LIQUID MANURE. A METHOD FOR THEIR DETECTION, Agency of Environmental Protection, Charlotten-

lund, Denmark. Fishery Lab.

O. Rump. Water Research, Vol 8, p 889-894, 1974, 3 tab, 8

Descriptors: \*Pollutant identification, \*Water pollution, \*Farm wastes, Analytical techniques, Phenols, Liquid wastes.
Identifiers: \*Phenolic acids, \*Pollution indicators,

Liquid manure.

This investigation is concerned with the development of a method to detect illegal liquid manure discharges. The method can be used to measure or detect water pollution. The investigation falls into two parts: (1) To find substances which are suitable indicators of liquid manure. (2) To develop an analytical method for the detection of such substances and test its application. M-hydroxybenzoic acid, m-hydroxyphenylacetic acid and m-hydroxyphenylpropionic acid in liquid manure occur in considerable quantities. They provide a sensitive analytical method for the detection of liquid manure is thin-layer chromatography on cellulose. The developed chromatograms are rendered visible by spraying with diazotized p-nitroaniline. By this method the minimum detectable amounts of the phenolic acids are approximately 0.01 ug. (Cartmell-East Central) W76-03979

CHROMATOGRAPHIC DETERMINATION OF CONSTITUENTS IN ETHERAL EXTRACTS FROM INDUSTRIAL WASTE WATERS (DEL CONSTITUENTI L'ESTRATTO ETEREO DI ACQUE INDUSTRIALI), G. Goretti, I. Marsella, and B. M. Petronio. La Rivista Italiana Delle Sostanze Grasse, Vol 51, No 2, p 66-69, February, 1974. 4 fig, 1 tab, 11 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Pollutant identification, Analytical techniques, Chromatography, Chemical analysis,

Identifiers: Thin-layer chromatography, Animal oils, Vegetable oils, Mineral oils, Silica gel plates.

Animal, vegetable, and mineral oil constituents of industrial waste waters can be quantitatively determined. This is accomplished by a type of thin-layer chromatography using silica gel plates. A 1:3 mixture of chloroform and benzene was employed as elution. The purpose was to assay components of ethereal extracts in industrial waste waters. (Murphy-FIRL) W76-03998

#### 5B. Sources Of Pollution

STOP LEACHATE PROBLEMS. Lenard Engineering, Storrs, Conn. M. Dilaj, and J. F. Lenard. Water and Wastes Engineering, Vol 12, No 10, p 27-30, 40, October 1975. 4 fig, 1 tab.

Descriptors: \*Leaching, Leachate movement, Ion exchange, Subsurface investigation, Observation wells, Water pollution, Water pollution sources.

Controlling leachate is one of the most important aspects of sanitary landfilling. Refuse decay starts out as an aerobic process but gradually develops into an anaerobic process. Water of decomposition is generally negligible except in highly putrescible organic wastes. Such wastes should be mixed with more stable materials before being placed in a landfill. The moisture content of the refuse will vary due to the type of storage practices, temperature, amount of precipitation, and type of refuse. When leachate leaves the site, the composition will depend on the amount of dilution obtained from infiltrating precipitation, ground-water flow, and from the physical conditions of the decomposition process. Purification starts in the landfill and continues through the subsurface environment by processes of filtration, ion exchange, adsorpand continues through the subsurface environment by processes of filtration, ion exchange, adsorp-tion and biological oxidation. Organic pollutants are broken down rapidly: inorganic compounds may migrate long distances. Before a sanitary landfill can be properly designed, geologic and hydrologic information of the proposed site must be accumulated and analyzed. Analysis of the data should include: (1) development of a water table contour map; (2) development of cross-sections through the landfill; (3) determination of the horizontal and vertical ground water flow pattern; (4) determination of the transmissibility of the soils in the saturation zone; (5) determination of soils in the saturation zone; (5) determination of approximate velocities in the zone of saturation; approximate velocities in the zone of saturation; and (6) ion-exchange properties of the subsurface environment. The design of a landfill site in Ledyard, Conn. using this approach is described. (Gass-NWWA) W76-03525

HYGIENIC EVALUATION OF EPOXY COM-POSITIONS INTENDED FOR USE IN WATER SUPPLY, (IN RUSSIAN), Vsesoyunznyi Nauchno-Issledovatelskii Institut

For primary bibliographic entry see Field 5C.

W76-03561

THE TUXTEPEC PAPER MILL (OAXACA, MEXICO) AND POLLUTION OF THE PAPALOAPAN RIVER (LA FABRICA DE PAPEL TUXTEPEC Y LA CONTAMINACION DEL RIO PAPALOAPAN),

Fabricas de Papel Tuxtepec, S.A., Oaxaca (Mexico) For primary bibliographic entry see Field 5C. W76-03577

POTENTIAL EFFECTS OF AQUACULTURE ON INSHORE COASTAL WATERS, Virginia Univ., Charlottesville. Dept. of Environ-

mental Sciences For primary bibliographic entry see Field 5C. W76-03585

HOW NOW BROWN COW: REGULATION OF FEEDLOT POLLUTION IN WISCONSIN, Harvard Law School, Cambridge, Mass. For primary bibliographic entry see Field 5G. W76-03590

HANLON CREEK ECOLOGICAL STUDY, PHASE A.
Guelph Univ. (Ontario). Centre for Resources Development.

For primary bibliographic entry see Field 5G.

MICROBIAL-MALATHION INTERACTIONS IN ARTIFICIAL SALT-MARSH ECOSYSTEMS: EF-FECT AND DEGRADATION, Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab.

A. W. Bourquin.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-246 251

\$4.50 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-660/3-75-035, June 1975. 41 p, 16 fig, 8 tab, 30 ref. GBERL 236, 1EA077.

Descriptors: \*Biodegradation, Ecosystems, Salt marshes, \*Pesticide residues, Bacteria, Descriptors.

Pesticide residues, Bacteria,
Microbiology.
Identifiers: Artificial ecosystems, Malathionmicrobial interactions, \*Malathion degradation.

Malathion is rapidly degraded in vitro by salt-marsh bacteria to malathion-mono-carboxylic acid, malathion-dicarboxylic acid and various phosphotionates as a result of carboxyesterase phosphotionates as a result of carboxyesterase cleavage. In addition, some expected phosphatase activity produces desmethyl-malathion, phosphotionates, 4-carbon dicarboxylic acids, and corresponding ethyl esters. In a simulated salt-marsh environment, malathion is degraded by the indigenous bacterial community. Numbers of bacteria capable of degrading malathion in the presence of additional nutrients increase in the sediments with increasing frequency of application and in the water column with the increasing level of treatment. Numbers of bacteria which degrade malathion as a sole carbon source are linked to the level of treatment in sediments and the frequency of treatment in the water column; however, these bacteria do no appear to play a significant role in the dissipation of malathion. It is believed that frequency of treatment increases nificant role in the dissipation of malathion. It is believed that frequency of treatment increases numbers of malathion co-metabolizing bacteria which catalyze a more rapid dissipation of the compound, which results in fewer sole carbon degraders. The disappearance of malathion in the salt-marsh environment is influenced by both chemical and biological degradation; however, at temperatures below 26 C and salinities below 20 0/00, chemical mechanisms appear to be of less importance than biological degradation (EPA) importance than biological degradation. (EPA) W76-03634

STUDIES ON VAPORIZATION AND HALOGEN DECOMPOSITION OF METHYL MERCURY COMPOUNDS USING GC WITH A MICROWAYE DETECTOR,

Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 5A. W76-03638

IRON BACTERIA AND RED WATER, Dearborn Chemical Div., Mich. S. Shair.

S. Snair. Industrial Water Engineering, Vol 12, No 2, p 16-18, March-April, 1975. 4 fig, 7 ref.

Descriptors: "Heavy metals, "Pollutants, "Iron, "Iron bacteria, Water quality, Pipelines, Microbiology, Bacteria, Chemical Precipitation, Microorganisms, Slime, Aerobic bacteria, Corro-

sion, Manganese.
Identifiers: "Red water, Ferric hydrate, Autotrophic bacteria, "Galionellas, "Chlamydobacteria, Pipe plugging, Iron oxide

A description is presented of a group of microorganisms known as iron bacteria and the problems they cause in water systems. Iron bacteria are capable of withdrawing iron present in their aqueous habitat and of depositing it in the form of hydrated ferric hydroxide on or in their mucilagenous secretions. They have caused serious

#### Group 5B—Sources Of Pollution

difficulty in industrial and fresh water systems by causing discolored water with an objectionable odor or taste and by clogging pipelines, nozzles, pumps and valves with their deposits. Generally, iron bacteria are autotrophic freshwater organisms with an optimum temperature range of 6 to 25 degrees C and a pH range from 5.5 to 8.2. They oxidize iron or manganese compounds as a source of energy. The bacteria are extremely difficult to grow in the laboratory with the usual cultural media. They can grow in light, shade, or total darkness. Falling in several genera, some are unicellular, either rods or coccoid forms, and some are filamentous. (Davis-Vanderbilt) W76-03640

THE DESIGN OF A MARINE ENVIRONMEN-

TAL SIMULATION SYSTEM, Data Industries Inc., East Providence, R. I. Ocean Data Equipment Div.

IEEE Ocean '75 Record, p 931-939, 1975, 9 fig.

Descriptors: \*Design, \*Simulation analysis, \*Systems analysis, Construction, Methodology, Descriptors: Salinity, Temperature, Oxygen, Turbidity, Physical properties, Laboratory tests, Model studies, \*Path of pollutants. Identifiers: \*Flow-through systems.

A marine environmental simulation system was designed to hold, rear and culture marine biota under conditions of controlled temperature, salinity, dissolved oxygen and turbidity. The physical requirements and limitations associated with parameter changes in the flow-through system were examined. A conceptual framework within which to optimally examine and describe the control problem was developed and then used to determine system requirements. Several implementations were developed and a particular configuration was recommended. (Klein) W76-03643

ENVIRONMENTAL SURVEYS OF OPEN-OCEAN DREDGE MATERIAL DISPOSAL

Naval Undersea Center, San Diego, Calif. S. Yamamoto, and J. B. Alcauskas. IEEE Ocean '75 Record, p 919-925, 1975. 4 fig, 6 tab, 16 ref.

Descriptors: \*Waste Descriptors: \*Waste disposal, \*Disposal, \*Oceans, Sediments, \*Surveys, \*Dredging, Wastes, Water pollution sources, Ecosystems, Physical properties, Sampling, Photography, Analytical techniques, Metals, Water quality, Benthic fauna, California, Pacific Ocean. Identifiers: \*Ocean disposal

Two 100-fathom open ocean disposal sites were monitored to assess the impact of the dumping of dredged materials upon the marine environment. One site was located 35 miles from San Fracisco, Ca. near the Farallon Islands and the other 7.7 miles from San Diego, Ca. Water quality and sediment parameters were measured and photographic surveys of the bottom were made with the Naval Undersea Center's remote-controlled research vehicle CURY III. The objectives of the Farallon site survey were to obtain qualitative descriptions of the physical, chemical and biological environment of the area and of the general release pattern of dredged materials. Although the material was desposited unevenly over the deposition area, most fell directly below the path of the hoppers. The purpose of the San Diego site survey was to monitor a previously unused dump site before, during and after dumping. Results of the predump survey showed the physical-chemical conditions of the area to be comparable to other near-shore areas of southern California. (Klein) W76-03644

THE SIGNIFICANCE OF DIISOCYANATE STA-BILITY IN WATER IN HYGIENIC STAN-DARDIZATION, (IN RUSSIAN), Ministerstvo Zdravookhraneniya S.S.S.R.

Moscow. Institut Biofiziki. E. D. Sopach, and L. P. Boltromeyuk. Gig Sanit, 7, 10-13, 1974.

Descriptors: \*Kinetics, Water pollution sources, \*Hydrolysis, \*Ureas, Water quality standards, Public health.

Identifiers: \*Amines, \*Cyanates, Diamines, Diisocyanates, Polyureas.

In order to standardize and assess contamination of water bodies with diisocyanates, stability of of water bottes with unsocyanates, stability of dissocyanates and of the products of their hydrolysis (Diamines) was studied. The quantitative relationship of diamines and polyureas was studied.—Copyright 1975, Biological Abstracts, Inc. W76-03648

DANGER OF PESTICIDE POLLUTION OF AR-TIFICIALLY REPLENISHED GROUNDWATER

RESERVES, (IN RUSSIAN), Nauchno-Issledovatelskii Institut Epidemiologii, Mikrobiologii i Gigieny, Vilnius (USSR). D. G. Krasil'shchikov.

Gig Sanit, 8, 90-91, Illus, 1974.

Descriptors: Artificial recharge, \*Groundwater recharge, \*Pesticide residues, \*Herbicides, Per-\*Groundwater colation, Sands, Detergents, Potable water, \*Chlorinated hydrocarbon pesticides, \*Path of pollutants. Identifiers: \*Sodium trichloroacetate, Sulfanol.

The degree of penetration of the water-soluble herbicide sodium trichloroacetate during vertical percolation of contamined river wwater through sands was studied. During 15-day percolation the polluted river water was not freed of the herbicide. Addition of the anionic detergent sulfonol to the water had no substantial effect on the degree or depth of penetration of the herbicide. Sodium trichloroacetate present in the initial waters can penetrate into artificially recharged drinking waters.—Copyright 1975, Biological Abstracts, W76-03649

HISTORICAL CHANGES IN MERCURY CON-TAMINATION IN MICHIGAN WALLEYES (STIZOSTEDION VITREUM VITREUM),

Michigan Univ., Ann Arbor. Grea Resource Management Program. T. M. Kelly, J. D. Jones, and G. R. Smith. Great Lakes

Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1745-1754, 1975. 4 fig, 3

\*Freshwater fish, \*Mercury, Descriptors: Metals, Path of pollutants, Water pollution, Water quality, Methodology, Dehydration, Analytical techniques, \*Walleye, Michigan, Water

pollution effects.
Identifiers: \*Michigan walleyes, Historical samples, Bioaccumulation, Tissue analysis.

Mercury concentrations in Michigan walleyes (Stizostedion vitreum vitreum) were more variable among localities than between recent and historical samples within localities. Walleyes in four of car samples within localities. Wanteyes in four of seven localities showed no statistical significant increases in the level of mercury contamination over the past 40 years. Methods for validly com-paring preserved and fresh specimens were established by tests to determine the weight loss through dehydration in preservation. In 74% alcohol, muscle tissue of medium to large walleyes dehydrated to about 70% of the fresh weight in the year. Mercury concentration in muscle from recent and old museum collections was positively correlated with age and size. Conable variation in concentration existed not only between geographic areas, but within populations, and even within subsamples of the same tissue. (Klein) W76-03652

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EXPERIMENTAL DESIGN IN SANITARY CHEMISTRY OF POLYMERS, (IN RUSSIAN), Vsesoyuznyi Nauchno-Issledovatelskii Institut Gigieni i Toksikologii Pestitsidovm Kiev (USSR). V. O. Sheftel. Gig Sanit. 8, 84-87, 1974.

Descriptors: \*Polymer, \*Potable water, \*Plastics, Chemicals, Organic compounds, Water pollution sources, Storage, Water pollution sources, Public

Experimental design and analysis are discussed and 2 examples of solving problems concerning the sanitary chemistry of polymers are presented, showing successful application. The 1st example was an investigation of polystyrene vessels for drinking water storage, where the concentration of styrene in the water was determined and the 2nd example was the determination of divinyl liberated from linoleum.--Copyright 1975, Biological Abstracts Inc.

AGRICULTURAL RUNOFF POLLUTES SUR-FACE WATERS, PART I, South Dakota State Univ., Brookings. Dept. of

Civil Engineerig.
For primary bibliographic entry see Field 5A.
W76-03719

EFFECTS OF A SANITARY LANDFILL ON GROUNDWATER QUALITY IN ASHLAND, NEW HAMPSHIRE,

New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
For primary bibliographic entry see Field 5C.

DEVELOPMENT OF IRON AND MANGANESE BACTERIA IN RANNEY WELLS

F. F. Barbic, M. V. Djindic, D. M. Bracilovic, S. M. Djorolijevski, and S. B. Milcic.

Journal of the American Water Works Association, Vol 67, No 10, p 565-572, October 1975, 6 fig,

Descriptors: \*Iron bacteria, Wells, \*Manganese, \*Iron, Europe, Clogging, Sedimentation, Bacteria. Identifiers: \*Ranney Wells, \*Ochre, Belgrade, Yugoslavia, Bacteria identification, Manganese bacteria

Results were discussed of an investigation involvochre, or iron ore, in the Ranney wells in Belgrade.

Research was conducted on 26 wells located on the right and left shores of the Sava River and on Sava Island of Ada Ciganlija. Glass and metal plates were placed in the drains of the Ranney Wells to observe bacteria growth, and the affinity of the bacteria to concentrations of ferrous and ferric iron. The exposure period for the plates was 20 to 30 days during the spring and again during the fall. The wells are 22 to 30 meters deep and the height of standing water in the wells varies from 2 to 14 meters. The drains are situated in sandy gravel just above the impermeable clay layer. The study found that bivalent iron must be accessible to bacteria, but not necessarily in the well water. As the water passes through horizontal drains, the ferrous ion is bound with bacteria so that no fer-rous ion is found in the shaft of the well where there is a great quantity of iron bacteria. The results also indicate that the drain plugging phenomenon of Ranney wells is complex and cannot be explained only by the microorganism activity. In general, ochre sedimentation increased with age of the wells. A decrease in yield is dependent on mechanical clogging of the well. (GassW76-03761

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THE MACRO-INVERTEBRATE FAUNA OF THE INTERTIDAL SOFT SEDIMENTS OF SOUTH EAST ENGLAND, Institute of Terrestrial Ecology, Norwich (England), Colney Research Station.
D. G. Kay, and R. D. Knights.

Journal of the Marine Biological Association of the United Kingdom, Vol 55, p 811-832, 1975. 8 fig. 9 tab, 14 ref.

Descriptors: \*Intertidal areas, \*Habitats, \*Speciation, \*Sediments, Population, Silts, Sands, Mussels, Invertebrates, Communities, Distribution patterns, Ecosystems.

Identifiers: Diversity, Hydrobia ulvae, Cardium

A survey of the macro-invertebrate fauna of the intertidal soft-sediments of southeast England was carried out. The most diverse community found was that of the mussel bed which was independent of sediment type and also showed the most abun-dant invertebrate fauna. Second in both abundan-cy and diversity was the community in the areas of varied sediments. Areas of fine silt and sand exhibited less abundant and diverse fauna and were dominated by Hydrobia ulvae. Many of the communities seemed to be related to the particle diameter of the sediment. (Klein) W76-03764

BIOCONCENTRATION TETRACHLOROBIPHENYL OF 2,2',4,4'-RAINBOW IN TROUT AS MEASURED BY AN AC-CELERATED TEST, Dow Chemical Co., Midland, Mich. Environmen-

tal Sciences Research.
For primary bibliographic entry see Field 5C.
W76-03766

RELATIVE IMPORTANCE OF FOOD AND WATER IN LONG-TERM ZINC-65 ACCUMULATION OF MARINE BIOTA, international Lab. of Marine Radioactivity, Monte

Carlo (Monaco). Oceanographic Museum. For primary bibliographic entry see Field 5C. W76-03780

HIGH ETHYLMERCURY IN RIVER FISH BY MAN-MADE POLLUTION,

Tokyo Dental Coll. (Japan). Dept. of Hygiene. S. Yamanaka, and K. Ueda.

Bulletin of Environmental Contamination and Toxicology, Vol 14, No 4, p 409-414, 1975. 4 fig, 8

Descriptors: Water quality control, \*Mercury, Methodology, Water pollution sources, \*Public Health, Fish, \*Industrial wastes, Dredging, Rivers, Analytical techniques, Pollutant identifica-

ition, Pollutants.

Identifiers: \*Jinzu River(Japan), \*Ethylmercury,
\*Thimerosal, Dace, Ayu, Plecoglossus altivelis,
Tribodon hakonensis.

High levels of mercury were found in fish from the Jinzu River, in a national surveys of mercury levels in river fish throughout Japan. Ethylmercury levels were far above the levels of methylmercury in dace (Tribodon hakonensis) and ayu(Plecoglossus altivelis); this was probably the first time that pollution by this compound was detected. The source was a factory synthesizing an antiseptic "Thimerosal", (Sodium ethylmercury thiosalicylate). The highly polluted bottom mud was dredged, removing the source of pollution, and the mercury level in dace dropped to the control level after four years. Characteristic differences between man-made and geologically con-High levels of mercury were found in fish from the ferences between man-made and geologically con-laminated rivers were noted. (Katz)

QUANTITATIVE BIOLOGICAL ASSESSMENT OF THE BENTHIC FAUNA IN DEEP BASINS OF THE GULF OF MAINE, Woods Hole Oceanographic Institution, Mass. G. T. Rowe, P. T. Polloni, and R. L. Haedrich. Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1805-1812, 1975. 1 fig, 3 tab. 34 ref. tab 34 ref

Descriptors: "Benthos, "Biomass, Speciation, Population, Communities, Sampling, Sediments, Ecosystems, Distribution patterns. Identifiers: Diversity, "Gulf of Maine.

The abundance, biomass and diversity of the macro- and mega-fauna in the deep basins of the Gulf of Maine were estimated from 41 quantitative infaunal samples and 17 visual transects. The homogeneous fine silt and clay sediments supported an infaunal abundance and wet preserved biomass which were relatively low for a continental margin with high sediment organic carbon. Diversity estimates from core samples were lower than core sample values from the continental slope, suggesting that the seasonally stable Gulf of Maine basins, because of their short geologic age. slope, suggesting that the seasonally stable Gulf of Maine basins, because of their short geologic age, do not yet contain an equilibrium assemblage. An additional possibility suggested was that seasonal variations in the production of organic matter, being more pronounced in the Gulf of Maine than offshore in deep water, affect community structure on the bottom. (Klein) W76-03783

ACCUMULATION AND APPARENT ABSENCE OF DDT METABOLISM BY MARINE COPEPODS, CALANUS SPP. IN CULTURE, Bedford Inst., Dartmouth (Nova Scotia). Marine

Ecology Lab. For primary bibliographic entry see Field 5C. W76-03784

PROBLEM OF MERCURIALISM IN CONNEC-TION WITH MERCURY POLLUTION OF THE ENVIRONMENT, (IN RUSSIAN), I. M. Trakhtenberg, and M. N. Korshun.

Gig Sanit. 8: 72-76, 1974.

Descriptors: \*Mercury, Heavy metals, Algae, \*Industrial wastes, Environment, \*Reviews, Aquatic animal, Fish, Water pollution effects, Water pollution sources, \*Environmental effects.

Literature on pollution of the biosphere with Hg compounds is reviewed. Effects on algae, mol-lusks, fish, calves, birds (eagles), experimental animals and humans (including children) are cited. Occupational exposure hazards are discussed. Hg pollution must be maximally decreased by reducing the industrial use of Hg, by banning the uses of Hg-containing fungicides and by effective methods of extracting Hg compounds from emissions and wastewaters .-- Copyright 1975, Biological Abstracts. Inc. W76-03796

DYNAMICS OF NITRIFICATION IN THE ACTIVATED SLUDGE PROCESS,
Tennessee Eastman Co., Kingsport.
R. A. Poduska, and J. F. Andrews.
Journal Water Pollution Control Federation, Vol
47, No 11, p 2599-2619, November, 1975. 18 fig, 5 tab, 26 ref.

Descriptors: \*Activated sludge, \*Waste water treatment, \*Model studies, Mathematical models, \*Nitrification, Water pollution sources.

Identifiers: Completely mixed reactors, Plug flow

A dynamic model was developed for the nitrification in the activated sludge process that relates the time-varying effluent concentrations of ammoni-um, nitrite, and nitrate nitrogen to the influent nitrogen concentration and flow rate. The model

was used to determine design criteria and opera-tion methods to improve the efficiency of nitrifica-tion. The model consists of five differential equations based on substrate and organism mass balances. The reactor process modeled was a sin-gle-stage, completely mixed aeration basin fol-lowed by a solids-liquid separator. Experimental verification of the model was obtained by step and impulse forcings of influent nitrogen concentraimpuise forcings of influent hitrogen concentra-tions and flow rates for continuous flow, completely mixed nitrifying suspended culture reactors operated at a pH of 7.2, temperature of 23 C, hydraulic retention time of 11 hr, and 10 day old sludge. The steady-state results of the model satisfactorily predict the level of nitrification re-ported in the literature for full-scale and pilot plant activated sludge plants. Model simulations have shown: the degree of nitrification in an activated sludge process depends on the sludge age; a plug flow reactor system will produce an effluent with a lower ammonium concentration than a completely mixed reactor for sludges younger than 5 days; the efficiency of nitrification is lower for dynamic operation than for steady-state operation when the sludge age is less than 5 days; and, a plug flow reactor is more resistant to toxic pulses with respect to maintaining nitrification than a completely mixed reactor. (Orr-FIRL) W76-03797

REVIEW OF THE MODELS OF TIDAL

WATERS, Monash Univ., Clayton (Australia). Dept. of Mechanical Engineering. J. B. Hinwood, and I. G. Wallis.

Journal of the Hydraulics Division, Proceedings of ASCE, Vol 101, No HY11, p 1405-1421, November, 1975. 1 ref, 1 append.

Descriptors: \*Mathematical models, \*Tidal waters, Water quality control, Water quality, Hydrodynamics, Estuaries, Waste

water(Pollution).
Identifiers: \*Tidal water modeling, Kinematic modeling, Estuarine modeling, Transport modeling, Waste movement models.

A classification scheme for water and waste move-A classification scheme for water and waste move-ment models previously had been defined based on the number of spatial dimensions and reference frames. Eulerian, Lagrangian and constant up-stream volume frames of reference were used. Hydrodynamic, kinematic and transport models were examined for each classification. A review of these models is undertaken. Zero-dimensional models were defined to estimate the seriousness of a waste discharge problem. They can only be transport models. One-dimensional Eulerian transport models. One-dimensional Eulerian models give accurate descriptions of waste concentration and movement in long estuaries. One-dimensional hydrodynamic models predict tidal elevations reasonably well. One-dimensional transport models predict longitudinal waste concentration. For one-dimensional non-Eulerian models, the frame of reference moves up and down the estuary with the tide, keeping a constant down the estuary with the tide, keeping a constant volume of water above it. Only transport models have been developed for this frame of reference. These models simulate water movement more closely than do Eulerian models. Two dimensional plan view models represent the longitudinal and lateral movement of wastes. Hydrodynamic models in this class can either include nonlinear acceleration or not. Tide heights were predicted very accurately with this model. These models work best for irregular estuaries with coriolis and work best for irregular estuaries with coriolis and wind circulations. Two dimensional side elevation models are limited to narrow estuaries that are well mixed laterally. Three dimensional models allow the complete spatial distribution of the waste field to be predicted. This type of modeling can be expected to develop rapidly in the next few years. (Pinto-FIRL) W76-03798

#### Group 5B-Sources Of Pollution

MULTI-PROCESS BIOLOGICAL TREATMENT

CH2M Hill, Bellevue, Wash For primary bibliographic entry see Field 5D. W76-03799

MATHEMATICAL MODEL FOR PHOSPHORUS MOVEMENT IN SOILS,
Michigan State Univ., East Lansing. Dept. of

Chemical Engineering.
D. B. Shah, G. A. Coulman, L. T. Novak, and B.

Journal of Environmental Quality, Vol 4, No 1, p 87-92, January/March, 1975. 3 fig, 16 ref.

Descriptors: \*Path of pollutants, \*Waste water treatment, \*Waste disposal, \*Groundwater move-ment, \*Phosphorus, \*Mathematical models, Model studies, Water pollution sources, Irrigation, Equations, Simulation analysis, Soil mechanics. Identifiers: Land application.

Because land treatment of municipal and industrial effluents is increasing as a disposal method, an understanding of the movement of phosphorus in the soil is needed. A model was developed to describe the quantitative behavior of water and phosphorus. It was shown that the water satura-tion profile travels faster than the phosphorus profile. The water distribution between irrigation in the Barriered Landscape Water Renovation System, constructed by Michigan University, had a negligible effect on phosphorus movement. The model formulated included material balance equations for water in the soil pore spaces, phosphorus in the liquid phase, and adsorbed phosphorus on the soil. Equations were solved numerically to simulate the phosphorus concentration profiles in the soil solution and in the soil as functions of depth for an operating waste disposal system. This type of model with predictive capacity is useful for the design of waste water irrigation sites which must be designed to minimize phosphorus leakage to the groundwater. (Kramer-FIRL) W76-03802

NITRATES IN WISCONSIN GROUND WATER,

Wisconsin State Lab. of Hygiene, Madison. B. Schuknecht, G. W. Lawton, P. Steinke, and J. J.

Environmental Letters, Vol 9, No 1, p 91-98, 1975.

\*Nitrates, \*Groundwater. \*Wisconsin, Wells, Chemical analysis, \*Pollutant identification, Sewage, Potable water, Bacteria, Nitrites, Public health.

Identifiers: Methemoglobinemia, Columbia county(Wisc), Dane county(Wisc), Phenoldisulfonic acid method, Automated diazotization technique.

Nitrates in groundwater are sometimes found in unacceptably high levels. In earlier studies they were found to be reduced by bacteria in infants digestive tracts to nitrites and cause methemoglobinemia. Nitrate analyses were per-formed on groundwater well samples originating from sources throughout Wisconsin. Wells of varying types, age and quality of construction were included in the test. The phenoldisulfonic acid method and an automated diazotization technique were used to determine the nitrate concentrations. Both techniques yielded comparable data. Results of the testing program showed that 38% and 39% of all wells in Columbia and Dane counties, respectively, had nitrate levels above the drinking water standard of 10 mg N03-N/liter. Most of the deeper wells had lower nitrate levels than shallow wells. In Columbia county nitrate levels were influenced by the relative proximity of the well to barnyards, sewage seepage areas, animal feedlots and liquid manure storage facilities. About 9% of samples selected randomly across the state had nitrate levels above 10 mg N03-N/liter, and six counties had 20% of the wells over the standard. Newer wells had considerably

lower nitrate levels than older wells, mainly due to the greater depth of the newer wells, and improved drilling and construction standards. (Pinto-FIRL) W76-03803

CHANGES OF THE GROUNDWATER SUPPLY CONDITIONS IN CONNECTION WITH CON-STRUCTION OF RESERVOIRS (BASED ON EX-PERIENCE OF THE GORKI RESERVOIR. (IN RUSSIAN).

Gorkovskii Meditsinskii Institut (USSR) For primary bibliographic entry see Field 5C. W76-03804

NITRATE NITROGEN DISTRIBUTION CORN LAND FOLLOWING APPLICATIONS OF DIGESTED SEWAGE SLUDGE Guelph Univ. (Ontario). Dept. of Land Resource

N. E. Stewart, E. G. Beauchamp, C. T. Corke, and L. R. Webber.

Canadian Journal of Soil Science, Vol 55, No 3, p 287-294, August, 1975. 1 fig, 5 tab, 15 ref.

Descriptors: \*Sludge \*Fertilization, \*Nitrogen, Nitrates, Ammonia. Anaerobic digestion, Environmental Agriculture. Identifiers: \*Nitrate nitrogen.

A study was conducted on the nitrogen distribution in crops and soil following applications of anaerobically digested sewage sludge. The follow ing topics were discussed; some of the physical and chemical characteristics of digested sewage sludge; the influence of several sewage sludge application rates on nitrate accumulation and subsequent movement through the crop-rooting zone during a growing season; the evaluation of a crop as a method of soil nitrogen removal; and, an as sessment of the nitrogen fertilizer value of digested sewage sludge with respect to crop yield. The digested sludge was applied to Harriston loam soil at rates of 0.0, 1.25, 2.5, and 5.0 cm/ha; corn was then grown on the plots. Nitrification of nitrate-nitrogen in the sludge occurred 6 days after application only in the top 20 cm of soil. The yields of corn grain and stover were significantly increased by sludge application rates greater than 1.25 cm/ha. The total-N concentration in the grain increased slightly at application rates above 1.25 cm/ha. About 3 to 12% of the total-N applied as sludge was removed by the corn. About 30% of the applied ammonium was lost one week after application due to volatilization. An annual sludge application on a Harriston loam on which corn grown should not exceed 1.25 cm/ha. (Orr-FIRL) W76-03814

GEOCHEMICAL FACTORS AFFECTING AR-TIFICIAL GROUNDWATER RECHARGE IN THE UNSATURATED ZONE. Geological Survey, Lubbock, Tex. For primary bibliographic entry see Field 5G.

W76-03818

FATE OF WASTEWATER SLUDGE IN THE NEW YORK BIGHT APEX,

State Univ. of New York at Stony Brook. Marine Sciences Research Center. For primary bibliographic entry see Field 5E.

ASSESSING PHYSICAL POTENTIAL FOR DEEP DISPOSAL OF INDUSTRIAL WASTES BY WELLS IN THE SOUTHEASTERN UNITED

STATES, Virginia Polytechnic Inst. and State Univ., Blacksburg. Div. of Environmental and Urban

For primary bibliographic entry see Field 5E. W76-03840

EFFECT OF INCINERATION THE ON METALS, PESTICIDES, AND POLYCHLORINATED BIPHENYLS SEWAGE SLUDGE.

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National Environmental Research Center, Cincinnati, Ohio, Advanced Waste Treatment Lab For primary bibliographic entry see Field 5D. W76-03845

DETERMINING ULTIMATE CAPACITY OF THE COASTAL ZONE FOR WASTEWATER AND WASTEWATER RESIDUALS, Rosenstiel School of Marine and Atmospheric

Science, Miami, Fla. For primary bibliographic entry see Field 5E. W76-03847

THE EFFECT OF SANITARY LANDFILLS ON WATER QUALITY IN SOUTHERN INDIANA, Indiana Univ., Bloomington. Dept. of Geography. D. B. Waldrip.

D. D. waturp.

Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-249 295, \$6.75 in paper copy, \$2.25 in microfiche. PhD The-sis, April 1975. 160 p. 28 fig. 25 tab, 88 ref., 5 ap-pend. OWRT B-049-IND(2), 14-31-001-3584.

Descriptors: \*Landfills, \*Solid wastes, \*Water pollution, \*Water pollution effects, \*Leachate, \*Indiana, Soil chemistry, Path of pollutants, Groundwater movement, Cation exchange, Water quality, Surface waters, Soil properties, Permea-bility, Groundwater.

Identifiers: \*Monroe County landfill(Ind), \*Brown County landfill(Ind), \*Columbus Municipal land-

A major environmental issue associated with sanitary landfills is the possiblity that decomposition of buried solid waste may cause deterioration of water quality. This research was undertaken to evaluate the degree of water quality change that may be expected by operating a sanitary landfill in southern Indiana. Three landfill sites were selected for study. The Monroe County and Brown County landfills are in dissected terrain with a surface cover of loess and/or alluvium overlying Borden siltstone, while the Columbus landfill is located in the White River floodplain. A detailed geologic and hydrologic investigation was conducted at each site to evaluate any water quality changes caused by landfilling. Surface water polluwas present at the Monroe and Brown County landfills. Diluted leachate was observed 700 yards downstream from the Monroe County landfill, while at the Brown County site all contamination was confined within the perimeter. At the Columbus landfill, severe groundwater contamination was observed but became diluted and dispersed within 100 feet of the landfill boundary. (Gibb-W76-03851

SEMI-INFINITE SOLID MODEL FOR PREDICTION OF TEMPERATURE IN DEEP RESERVOIRS AND LAKES, Arkansas Univ., Fayetteville. Dept. of Chemical

Engineering. For primary bibliographic entry see Field 2H. W76-03852

APPENDIX 7, WATER QUALITY LAKES BASIN FRAMEWORK STUDY WATER QUALITY, GREAT Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 5A. W76-03864

AN EVALUATION OF THE ACCUMULATION. AN EVALUATION OF THE ACCUMULATION,
TRANSLOCATION, AND DECRADATION OF
PESTICIDES AT LAND WASTEWATER
DISPOSAL SITES,
California Univ., Berkeley. Sanitary Engineering

Research Lab.

S. A. Klein, D. Jenkins, R. J. Wagenet, J. W.

Biggar, and M. S. Yang. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as AD/A-006 551. Price \$8.00 in paper copy, \$2.25 in microfiche. SERL Report No. 74-4, November 1974. 235 p. 27 fig, 98 tab, 43 ref, 5 append. DADA-17-73-C-3109.

Descriptors: \*Pesticides, \*Insecticides, \*Soil disposal fields, \*Evaluation, \*Water pollution sources, \*Path of pollutants, Soil analysis, Water analysis, Degradation(Decomposition), Water disposal, Water pollution, Organophosphorus disposal, Water pollution, Örganophosphorus compounds, Poisons, Diazinon, Decomposing organic matter, Organic wastes, Oxidation, Soil surfaces, Irrigation, Waste water disposal, Organophosphorus pesticides, Lysimeters, Waste water(Pollution), Soil types. Identifiers: \*Organophosphates, \*Biocide accumulation, \*Biocide degradation, \*Biocide translocation, Malathion, Carbaryl, 2,4-D butoxyethyl ester, Spray irrigation.

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The purpose of the investigation was to determine the fate of Malathion, Carbaryl, Diazinon, and 2,4-D butoxyethyl ester during sewage spray irrigation at land disposal sites. Biocide accumulation and degradation in soil and translocation in soil and water was assessed. Sheltered soil lysimeters were water was assessed. Stretches weekly at a loading rate of 2 in. per week with wastewaters containing 0.1 mg/l of each biocide. Five soils ranging in type from finely textured to coarsely textured were examined and two of these soils were also studied in ammed and two of these soils were also studied in field plots. Initially lysimeters and field plots were stabilized by irrigating with secondary effluent containing biocides. A series of changes consisting of cationic slugs (Mg and Na), increased organic loading, and simulated rainfall (biocide-free) were imposed. Lysimeter results indicated Diazinon ac-cumulation of a low level in upper soil regions and high levels of Diazinon and Malathion only at soil surfaces. Carbaryl was never observed in soils or soil waters and no significant accumulation of the other biocides was detected. Field plot results demonstrated that gross movement of Diazinon and Malaoxon could occur under unusual conditions only. Their movement was attributed to drying and cracking of soil, followed by heavy rainfall. Another contributing factor was periodic removal of vegetation which removed a barrier that appeared to intercept the biocides. Inormation on mineral pickup was gathered from both lysime-ters and field plots. The mineral quality of the effluent appeared to be influenced more by soil type than character of applied wastewater. (Henley-W76-03871

RELATIONSHIPS BETWEEN PRECIPITATION, STREAM WATER CHEMISTRY, AND VECETATION FOR THE BOWL, A FORESTED WATERSHED IN NEW HAMPSHIRE, New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources. For primary bibliographic entry see Field 4D. W76-03875

OCCURRENCE OF CHLORINATED OCCURRENCE OF CHLORINATED HYDROCARBON INSECTICIDE, SOUTHERN FLORIDA--1968-72, Geological Survey, Miami, Fla. H. C. Mattraw, Jr. Pesticides Monitoring Journal, Vol 9, No 2, p 106-114, September 1975. 7 fig, 2 tab, 12 ref.

Descriptors: \*Pesticide residues, \*Water pollution sources, \*Insecticides, \*Chlorinated hydrocarbon pesticides, Surface waters, \*Florida, DDT, DDD, DDE, Agricultural runoff, Path of pollutaris, Sampling, Chemical analyses, Canals, Sediments, Hydrologic system.

Identifiers: Southern Florida, \*Everglades(Fla).

The frequency with which chlorinated hydrocarbon insecticides appear in samples of southern Florida surface waters decreased sharply between 1968 and 1972. Sediment analyses attest to the earlier widespread use of chlordance, DDT, and dieldrin. Insecticide residues are more frequently detected in southern Florida than in other U.S. cropland soils. Transport of DDT, DDD, and DDE from the Everglades agricultural area into water conservation areas and undeveloped parts of the Everglades of southwestern Florida is facilitated by a system of water-management canals. Canal sediments within the urban area of souther Florida entrations which may reflect local use of insecticides rather than their transport from adjacent agricultural areas. (Woodard-USGS) W76-03898

STREAM QUALITY IN RELATION TO MINE DRAINAGE IN COLORADO, Geological Survey, Denver, Colo. D. A. Wentz.

In: Water Resources Problems Related to Mining: American Water Resources Association Proceedings Series No 18, p 158-173, June 1974. 5 fig. 5 tab. 31 ref.

Descriptors: \*Water pollution sources, \*Mine drainage, \*Surface waters, \*Streams, \*Colorado, Water quality, Chemical analysis, Trace elements, Coal mines, Acidic water, Data collections, Path of pollutants.
Identifiers: \*Metal mining(Colo).

Most of Colorado's metal deposits are composed of sulfide ores. Oxidation of associated pyrite yields acidic water, which in turn dissolves other metal sulfides and releases trace elements to the surface drainage. The process is relatively unim-portant in coal deposits within the State. Trace ele-ments in Colorado streams do not often follow a normal or simple lognormal frequency distribu-tion. Concentrations of cadmium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, vanadium, and zinc occur in greater concentra-tions in streams draining metal-mining areas than in streams draining coal-mining or control areas. of these, cadmium, cobalt, copper, manganese, nickel, and zinc tend to occur together. Arsenic, chromium, mercury, selenium, and silver do not seem to occur at anomalously high levels in metalor coal-mining areas. Based on this study, it is sug-gested that field measurements of specific con-ductance and pH can be used as a guide in the selection of streams affected by metal mining. Visual observations of stream conditions can also help. In situations where visual observations are difficult (for example, groundwater studies), mea-surement of one or more indicator chemical con-stituents may be feasible. In Colorado, zinc, and possibly sulfate, might be used in this regard. (Woodard-USGS)
W76-03900

THERMODYNAMIC CONSTRAINTS ON METAL SOLUBILITIES IN A STREAM AFFECTED BY MINE DRAINAGE, BONANZA, COLORADO,

Geological Survey, Denver, Colo. R. E. Moran, and D. A. Wentz.

In: Water Resources Problems Related to Mining: American Water Resources Association Proceedings Series No 18, p 54-64, June 1974. 8 fig, 1 tab, 15 ref.

Descriptors: \*Water pollution sources, \*Mine drainage, Streams, \*Colorado, \*Metals, Solubility, Water chemistry, Trace elements, Chemical precipitation, Chemical analysis, Thermodynamic behavior, Cadmium, Copper, Iron, Lead, Man-ganese, Nickel, Zinc. Identifiers: \*Bonanza(Colo).

Drainage from abandoned metal mines and tailings piles has resulted in acid, metal-liferous surface water in the vicinity of Bonanza, Colo. Much of the streambed is coated with amorphous Fe(OH)3

that contains significant concentrations of other metals. Using thermodynamic techniques, it was found that several compounds other than Fe(OH)3 could be precipitating. These compounds include Cu2(OH)2CO3, Cu3(OH)2(CO3)2, Cu3(OH)4SO4, Cu4(OH)6SO4.H2O, MnCO3, and Zn2SiO4. Solubility and the control of the bility products were not exceeded for any of the cadmium, lead, or nickel compounds considered. (Woodward-USGS) W76-03901

FINITE ELEMENT SOLUTIONS TO TWO GROUNDWATER FLOW PROBLEMS - ONE INCLUDING DISPERSION AND THE OTHER THE INFLUENCE OF ELECTRO-OSMOSIS, California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering. T. S. Nishi, J. C. Bruch, Jr., and R. W. Lewis. Available from NTIS, Springfield, Va 22161 as PB-249 181, \$4.50 in paper copy, \$2.25 in microfiche. College of Engineering, UCSB-ME-75-3, August 1975. Sp. 6, 6ig, 35 ref, 6 append. (California Water Resources Center Project UCAL-WRC-W-428).

Descriptors: \*Finite element analysis, Groundwater, \*Base flow, \*Dispersion, \*Electro-osmosis, Groundwater movement, \*Path of pollutants, Seepage, Recharge wells.

Identifiers: Convection dispersion.

Man's concern with the destruction of his environman's concern with the destruction of his environ-ment has promoted an interest in the knowledge of the movement of pollutants in groundwater aquifers. This study concerns itself with two problems in this area: (1) hydrodynamic dispersion in seepage from a triangular channel, and (2) the influence of electro-osmosis on flow in an aquifer with a recharge and discharge well. The finite element method using rectangular elements is em-ployed to solve two-dimensional isotropic, homogeneous hydrodynamic flow and dispersion in the first problem and the effect of electro-osmosis on the hydrodynamic flow field in the second problem. Also, included are comparisons between finite element, finite difference and analytical solutions of a test dispersion-convection problem. The finite element results compare favorably with the analytical solution and do not exhibit the numerical dispersion problems that arise in the finite difference solution. (Snyder-Calif, Davis) W76-03962

POLLUTANT MOVEMENT BENEATH RIVERS, California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering. J. C. Bruch, Jr.

J. C. Bruch, Jr.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 453, \$4.00 in paper copy, \$2.25 in microfiche. Technical Completion Report, July 1975, 23 p. 12 ref. (California Water Resources Center Project UCAL-WRC-W-428).

Descriptors: \*Pollutants, Water pollution control, \*Groundwater movement, Convection, \*Dispersion, \*Path of pollutants, \*Seepage, Open channels, Rivers, \*Finite element analysis. Identifiers: \*Convection-dispersion equation

The work completed in this project deals with the movement of pollutants beneath open channels. This movement is considered to be caused by the dispersion and convection effects. The phenomenon of the reaction of the waste constituents with the porous media and the decay of the constituents with time were not dealt with, but could easily be included in the general algorithm. There are two distinct, yet coupled parts, to the convective-dispersion problem. The equation of motion for the resident fluid provides the necessary information concerning the seepage flowfield, while the convective-dispersion equation describes the behavior of the pollutant. Each of these will be described separately and then combined for the total problem. Examples and com-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION Group 5B-Sources Of Pollution

parisons are given with other published data. (Snyder-Calif, Davis) W76-03963

SURFACE RUNOFF IN DAIRIES. California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering. A. C. Chang, D. Aref, and D. C. Baier. California Agriculture, Vol 29, No 4, p 16-17, April, 1975. 2 fig, 2 ref.

Descriptors: \*Farm wastes, \*Agricultural runoff, \*Dairy industry, \*Water pollution, \*California, Hydrology, Suspended solids.

Surface runoff usually carries a high water pollution potential if it comes from livestock-manured areas. In an area such as the Chino-Corona dairy preserve, which has a heavy concentration of livestock, manure-laden runoff could be a significant portion of the total surface runoff of the watershed and could degrade the quality of the receiving stream. The purpose of this study was to attempt to determine the hydrologic and water quality characteristics of surface runoff from this area. Researchers simulated precipitation on the surface of dairy corrals where animals are confined, rather than wait for runoff-generating storms. A table is provided which summarizes the hydrologic characteristics of each delivered precipitation and its resultant runoff. The transport of suspended solids by overload flow did not appear to be a serious problem on mildly-sloped land, although the loss of dissolved minerals to surface runoff was significant. Channels have a tendency to be formed by overland flow traveling a long distance; this channelled flow with higher velocity would transport larger amounts of loose-ly-packed wastes. No channel was formed under experimental conditions. This information leads to the conclusion that a well-sloped corral surface would minimize the loss of suspended material through runoff. (Penrod-East Central) W76-03970

POLLUTANT MOVEMENT TO GROUND WATER FROM SWINE WASTE LAGOONS, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
T. G. Ciravolo, K. L. Hallock, H. R. Thomas, E.
R. Collins, Jr., and D. C. Martens. 1973-74 Livestock Research Report, Research Division Report 158, Virginia Polytechnic Institute and State University, Blacksburg, July, 1974, p 5-10. 4 tab

\*Farm wastes, \*G \*Anaerobic conditions, Descriptors: \*Groundwater, \*Lagoons, \*Anaerobic condition \*Nutrients, Hogs, Water pollution. \*Coliforms,

Flushing swine wastes into an anaerobic lagoon is a relatively inexpensive waste disposal method. Information from a literature search indicates that there may be seepage from such a lagoon. The purpose of this study is to monitor the effect of seepage from anaerobic swine lagoons on ground water quality. The two lagoons studied are located in high water table soils in the Coastal Plain Region of Virginia at the Tidewater Research and Continuing Education Center and at the Virginia Swine Evaluation Station. The wells, consisting of 2 inch PVC pipe, were water jetted at distances of 10, 50 and 100 ft. from the two anaerobic swine lagoons to depths of 10, 15, and 20 ft. At the 20 ft. depth that was 50 ft. from the lagoon at the Swine Evaluation Station in August and at the 10 ft. depth located 50 ft. from the lagoon in November, the 0.1 ppm Cu recommended limit was exceeded. Chemical-oxygen-demand, coliform bacteria, and concentration of Cl-, NO3-, NH4+, soluble phosphate, Mg++, K+, Na+, Cu++, Zn++, and Mn++ were the constituents being determined in ground water samples. Preliminary analyses summary shows that U.S. Public Health Department drinking water standards were not exceeded for Cl-, Cu++, NO3- and Zn++. Fluctuations in the

chemical constituents concentrations indicated that ground water contamination occurred only at 10 ft. distances. A study is continuing with chemical oxygen demand and fecal coliform bacteria being determined. (Penrod-East Central) W76-03973

A SURVEY OF EFFECTS OF ANIMAL WASTES ON STREAM POLLUTION FROM SELECTED

DAIRY FARMS, Clemson Univ., S.C. Dept. of Dairy Science. J. J. Janzen, A. B. Bodine, and L. J. Luszcz. Journal of Dairy Science, Vol 57, No 2, p 260-263, February, 1974. 3 tab, 5 ref.

Descriptors: \*Farm wastes, \*Water pollution, \*Dairy industry, Sampling, \*Coliforms, \*South Carolina, \*Biochemical oxygen demand, \*Chemical oxygen demand, Nutrients, Hydrogen

A study was conducted in South Carolina in which water was sampled from streams adjacent to selected dairy farms. The waste management systems utilized by these farms were lagooning, dry disposal, and liquid manure handling. Stream samplings were taken above, adjacent to, and below the major animal waste drainage areas. It was determined that 42 percent of the selected farms contributed in varying amounts to a reduc-tion in stream water quality. Twenty-six percent of these farms contributed to significant increases in fecal coliform concentrations. Studies are underway to determine the effects of depth, site, and frequency of sampling on measures of stream water quality. Water quality data is also being collected for streams draining virgin lands that are free of domesticated animals. (Penrod-East Cen-W76-03974

REVIEW PAPER: ANIMAL WASTES MANAGE-MENT AND CHARACTERIZATION

Utah State Univ., Logan. Div. of Environmental Engineering.
J. E. Middlebrooks.

Water Research, Vol 8, p 697-712, 1974. 1 fig, 13 tab. 46 ref.

Descriptors: \*Farm wastes, Physical properties, Chemical properties, \*Agricultural runoff, \*Waste treatment, \*Nutrients, \*Feed lots, \*Confinement pens, Locating, Lagoons.
Identifiers: \*Waste management, Land disposal, Retention ponds.

Agricultural-related environmental quality problems have received little attention until the last 10 years. The purpose of this report is to at-tempt to provide an overall picture of the characteristics and treatability of animal wastes and ru-noff from animal feedlots. The study showed that there is a wide variability in both the characteristics and performance of treatment facilities. Loehr (1972) proposed several feedlot runoff control measures, such as retention ponds, use of evaporation ponds, diversion, land disposal of the excess liquid and accumulated solid matter, confinement, and proper location. All of the above methods can easily be adapted to fit a particular situation under certain environmental conditions.
Application of one or all of these methods depends on such factors as rainfall patterns for a particular on such factors as raintail patterns for a particular area, rainfall amount and frequency, and geography. Location selection is possibly a key in the control of feedlot and animal waste pollution. Another significant factor in controlling feedlot and animal waste pollution is the number of waste management alternatives that are made available to a feedlot operator. However, it appears that the agricultural industry is incapable of absorbing the costs of conventional waste treatment at this time. Therefore, whenever possible, feedlot location should be such that the old reliable method of confinement and land disposal can be employed. (Penrod-East Central)

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BASIN TERRACED FEEDLOT, Nebraska Univ., Lincoln. Agricultural Experiment Station.

L. F. Elliott, T. M. McCalla, N. P. Swanson, L. N. Mielke, and T. A. Travis. Transactions of the ASAE, Vol. 16, No. 2, p. 285-286, 293, March-April, 1973. 10 ref.

\*Farm wastes, Descriptors: \*Nitrates, \*Feed lots, Agricultural runoff, Nebraska, Denitrification. Identifiers: \*Broad-basin terraced feedlot.

Nitrate accumulations occur beneath some feedlots but not others. Some recent studies indicate the possible role of management in nitrate accumulation beneath feedlots. More recent reports indicate continuous stocking of feedlots may preclude nitrate accumulations beneath them. Further investigation is warranted as runoff-control systems may complicate the situation. Swanson (1973) described a broad-basin terrace system that meets Nebraska runoff-regulatory requirements. The objective of this study was to determine if excessive nitrate accumulations in the feedlot soil profile would be caused by this system. Initiated in an 8-month-old, broad-basin terraced feedlot, caisson studies showed that soil water nitrate values rose initially. When the study was terminated, after 13 months, N03 - N at 2, 4, and 5 ft, was 1.4, 10, and 12.5 ppm, respectively. Oxygen decreased and C02 increased during the latter part of the test period, indicating reducing conditions were occurring. The establishment of reducing conditions and the decrease in nitrate are indications of denitrification. Test results in-dicated that nitrate did not percolate below 5 ft. (Penrod-East Central)

DETERMINING APPLICATION RATES OF LIVESTOCK WASTES TO THE LAND, Illinois Univ. at Urbana-Champaign. Soil Fertility

Extension. S. R. Aldrich.

Presented at Proceedings of 1973 Livestock Waste Management Conference, Champaign, Illinois. March 7-8, 1973, p J1-J12. 1 fig, 1 tab, 26 ref.

Descriptors: \*Farm wastes, \*Livestock, \*Poultry, Nitrates, Water pollution, Groundwater pollution, Phosphorus, Salts, Ammonia, Denitrification, Agricultural runoff, Application rates. Identifiers: \*Land disposal.

Much trial and error has occurred in trying to determine the application rates of livestock wastes to the land. The objective of this report is to examine the disposal on agricultural land of collected animal wastes. The study showed that the safest program for manure disposal consists of 10-20 tons of large-animal waste or 5-10 tons of poultry waste per acre per year applied for the purpose of efficient utilization by responsive crops. In the im mediate future, the permissable manure loading on agricultural land will be determined by the amount agricultural iand will be determined by the amount of nitrogen. Between 150 and 250 pounds is the amount of nitrogen that can be introduced into the soil annually without substantial buildup in N03. Poorly drained, fine-textured soils are sites that maximize denitrification and will tolerate heavier rates than well-drained, coarse-textured soils. The permissable rate of manure may be increased if the receiving water is low in nitrate and is large in volume relative to the water from the manured area. Where the water is discharged to a lake or reservoir directly or via a stream, the amount of phosphorus in drainage water may be the limiting factor in waste application. Ammonia concentration or salt concentration or both may limit the amount of manure that can be applied at one time without injuring germination and plant growth. On sloping land where runoff into surface waters is likely with normal rainfall, large surface applications are not acceptable. Future designing of large livestock operations must include proper waste disposal in the planning. (Penrod-East Central)

### WATER QUALITY MANAGEMENT AND PROTECTION-Field 5 Effects Of Pollution-Group 5C

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AGRONOMIC CONSIDERATIONS OF ANIMAL WASTE DISPOSAL, Iowa State Univ., Ames. Cooperative Extension

R. D. Voss.

Presented at Midwest Livestock Waste Management Conference, Iowa State University, Ames, November 27-28, 1973, 7 p, 5 ref.

Descriptors: \*Farm wastes, \*Waste disposal, Agronomy, \*Crop response, \*Nitrogen, \*Phosphorus, Nutrients, Salts. Identifiers: \*Land disposal.

In this paper the assumption is made that the soil's usefulness for crop production is to be maintained. The primary concern is if land disposal of animal wastes is the ultimate goal, how much can be applied without causing short or long term problems. Short term effects would include: salt and toxic effects on germination and growth of plants, loss of intents is deviaged were reconsulted. fects on germination and growth of plants, loss of nitrate in drainage water, crop quality, crop yields, and surface runoff. Long term effects would include: crop productivity, accumulative salt effect on crops, dispersal of soils by accumulation of sodium, and nutrient imbalance due to phosphorus or other element buildup. Suggested optimum rates of application of animal wastes for efficient will be accompanied to the nutrients by bested grosses as rates of application of animal wastes for efficient utilization of the nutrients by harvested crops are 10 to 20 tons per acre on a fresh weight basis according to several authorities. Plans for any animal waste handling system should include provision for waste disposal. The plans should be according to guidelines which, hopefully, will include agronomic considerations. (Penrod-East Central) W76-03987

HYDROLOGY OF OPEN FEEDLOTS IN THE

CRONBELT, Nebraska Univ., Lincoln. Agricultural Experiment

Station. N. P. Swanson.

Presented at Midwest Livestock Waste Management Conference, Iowa State University, Ames, November 27-28, 1973, 11 p, 1 fig, 21 ref.

Descriptors: \*Farm wastes, Hydrology, \*Feed lots, Rainfall, Snow, Evaporation, Agricultural runoff, Snowmelt, Groundwater, Water poliution. Identifiers: Solids losses.

The purpose of this study is to examine the hydrologic factors of open feedlots in the corn belt. The factors discussed are: temperature, snow, evaporation and rainfall. Since the hydrologic impact of feedlots is on the immediate watershed, hydrology should be considered in feedlot design and management. Rapid drainage of a feedlot is very desirable and is improved by the utilization of mounds and drainways, terraces and hasins and inlet risers with underground drains. utilization of mounds and drainways, terraces and basins, and inlet risers with underground drains. Runoff control facilities should be desinged for periods of probable high-intensity and maximum intensity precipitation without opportunity for runoff disposal. The study showed that underground water pollution from livestock feeding installations appears to be mostly a local problem with widespread contamination of aquifers not appearing probable. Runoff will be greater and start sooner from a feedlot than from adjacent cropland. There can be appreciable water storage in the soilmanure mixture. The study also indicated that There can be appreciable water storage in the soil-manure mixture. The study also indicated that snowmelt runoff may contain 10 to 12 times the chemical oxygen demand and solids content of a rainfall-runoff from the same lots. It was noted that similar runoff facility design capacities can be expected in the Corn Belt states, except in western Kansas, Nebraska, and South Dakota. (Penrod-East Central)
W76-03990

GROUNDWATER CONTAMINATION CAUSED BY WASTE WATERS GENERATED IN GAL-

VANIZING PLANTS (GALVANUZEMI SZEN-VANIZING PLANIS (GALVANUZEMI SZEN-NYVIZ ALTAL OKOZOTT TALAJVIZSZEN-NYEZESEK), C. Mihaly. Hidrologiai Kozlony, Vol 54, No 2, p 62-64, February, 1974. 2 fig, 7 ref.

Descriptors: \*Waste water treatment, \*Groundwater, \*Heavy metals, \*Metals, Waste discharge, Water pollution control, Waste water(Pollution), Cyanides, Industrial wastes,

Wells, Europe.
Identifiers: \*Electroplating industry, Chromates, Groundwater contamination, Hungary, Percola-

Instances of groundwater contamination by electroplating shop-generated effluents in Hungary are presented. Wells nearby percolation grounds used for the discharge of such effluents containing cyanides, chromates, and other heavy metals were contaminated for over six years. Water samples taken from such wells contained chromates well above the maximum allowable level. Even smallcapacity electroplating plants discharging less than one cu m treated waste water daily were found to possibly cause serious groundwater contamination. Two cases of eczema due to chromate-contaminated wellwater occurred. None of the contaminated groundwater samples contained trivalent metals due to their rapid adsorption in the ground. Good adsorption of bivalent metals such as copper and zinc in loamy loess was observed. Low rates of adsorption of free cyanide, and the practical absence of adsorption of chromates were found. Treated effluents containing heavy metals should not be discharged in a 1.5 km radius around inhabited areas and areas being or to be used for water supply. (Takacs-FIRL) W76-03996

STUDIES ON SUBSURFACE MOVEMENT OF EFFLUENT FROM PRIVATE SEWATE DISPOSAL SYSTEMS USING RADIOACTIVE AND DYE TRACERS, PART 2, 1973-74, Ontario Ministry of the Environment, Toronto.

M. Brandes

1975. 54 p, 7 fig, 3 tab, 17 ref, 4 append.

Descriptors: Waste water treatment, \*Waste water disposal, \*Tile drains, \*Septic tanks, \*Tracers, Phosphorus, \*Path of pollutants, Soils, Water pollution sources, Tracking techniques, Radioactive techniques.
Identifiers: \*Radioactive tracers.

Radioactive and dye tracers, Tritium, 32P, and Fluorescein, were used to study the underground movement of septic tank effluents from 4 individual sewage disposal systems towards the receiving bodies of water, Lake Couchiching and Little Lake, both in Canada. Tritium was an excellent tracer, however, radioactive phosphorus and fluorescein are not recommended as tracers in soil. The sewage disposal systems consisted of septic tanks and tile fields. The three sites on Lake Couchiching were built on clayey-silt soil. The site on Little Lake was built on imported sand. The tile fields produced a relatively high removal of phosphorus, 78% in sand fields and 90% in clayeysilt fileds. The sewage disposal systems had no effect on the concentration of nitrates in groundwater. The concentration of free ammonia in groundwater from bore holes drilled in clayey-silt soil was lower than from holes in sand. Some part of the ammonia is retained by the finer grain size soil. All of the sewage disposal systems satisfactorily removed coliform organisms. Flooding of the tile fields had no harmful effect on the concentration of pollutants in groundwater. (Orr-FIRL)

#### 5C. Effects Of Pollution

EXPERIMENTAL RESEARCH DATA ON HY-GIENIC EVALUATION OF THE METHOD OF MAGNETIC TREATMENT OF WATER, (IN RUSSIAN), Nauchno-Issledovatelskii

Institut

Nauchno-Issledovatelskii institut Gigietty, Moscow (USSR). N. V. Klimkina, Y. V. Novikov, M. M. Saifutdinov, G. V. Tsyplakova, and A. N. Sergeev. Gig Sanit. 12. 15-19, Illus. 1974.

Descriptors: \*Water treatment, Magnetic studies, \*Cytological studies, Water pollution effects, Potable water, Rodents, Public health. Identifiers: Blood cells, \*Magnetic treatment(Water), Central nervous systems(Rats).

The effects of water treated by a magnetic field (intensity of 1300, 2000 and 5000 E (oersted)) on al-(intensity of 1500, 2000 and 5000 E (cersted)) on altimine rats drinking it for a long period of time were studied. The water treated by 5000 E magnetic field caused changes in the CNS, the red and white blood cells and internal organ cell morphology.—Copyright 1975, Biological Abstracts, Inc. W76-03536

EUTROPHICATION IN THE HELSINKI AND ESPOO SEA AREAS MEASURED AS PHYTOPLANKTON PRIMARY PRODUCTION, Helsinki Univ. (Finland). Dept. of Limnology. P. O. Lehmusluoto, and L. Pesonen. Oikos, Supplement 15, p 202-208, 1973. 5 fig. 3 tab,

Descriptors: \*Eutrophication, \*Bays, \*Gulfs, \*Primary productivity, \*Water pollution sources, Outfall sewers, Dominant organisms, Waste dlution, Phosphorus, Nitrogen, Cyanophyta, Diatoms, Europe, Nutrients. Identifiers: \*Gulf of Finland, Helsinki(Finland), Espoo(Finland).

To determine the effects of domestic sewage in the Gulf of Finland near Helsinki and Espoo, phytoplankton primary production was determined during 1966-1970. Primary production exceeded 1.0 g C/sq m/day in the inner bays. At the outermost stations it was usually less than 0.3 g C/sq m/day. Annual phytoplankton primary production varied in the inner bays from 68.6 to 192.5 and in outer stations from 15.0 to 39.0 g C/sq m/yr (the latter values were considered purmal for 192.5 and in outer stations from 15.0 to 39.0 g C/sq m/yr (the latter values were considered normal for unpolluted parts of the Gulf of Finland). Phytoplankton primary production was 5 to 10 times higher in polluted inner bays than in the open sea. Slight eutrophication was observed when total phosphorus exceed 40 mg P/cu m. In strong eutrophic zones, total phosphorus concentration was over 200 mg P/cu m. The mean ratio of soluble N:P compounds during the growth period in strong eutrophic zones was very low (about 3). In very euthrophic zones was very low (about 3). In very euthrophic zones blue-green algae (Oscillatoria agardhii) dominated and the largest phytoplankton biomass was in July-September while in the outer archipelago, it was in May. Diatoms and flagellates dominated offshore. Light was the limiting factor at the most polluted stations in summer; nutrients at the most polluted stations in summer; nutrients were limiting in the other stations. (Buchanan-Davidson--Wisconsin) W76-03537

COMPETITIVE EXCLUSION AMONG THREE PLANKTONIC BLUE-GREEN ALGAL SPECIES, Cincinnati Univ., Ohio. Tanner's Council Lab.

W. Lange.
Journal of Phycology, Vol 10, No 4, p 411-414, 1974. 3 tab, 8 ref.

Descriptors: \*Competition, \*Cyanophyta, \*Deficient elements, Nutrients, Nostoc, Iron, Trace elements, Bacteria, Growth rates, Dominant organisms, Laboratory tests.

Identifiers: Microcystis aeruginosa, Phormidium foveolarum. Nostoc muscorum

#### Group 5C-Effects Of Pollution

The decline of an algal species in a group of cyanophytes is apparently caused by an insufficient supply of certain nutrients. The effect of one algal species on growth of other members of a three species blue-green algal community was determined by measuring the modification of the rate of cell division. The bacteria-associated algae. Microcystis aeruginosa, Nostoc muscorum, and Phormidium foveolarum, were cultivated on Zehnder-Gorham's medium Number 11 individually and in combination. Growth rates of Microcystis and Nostoc were reduced by the presence of Phormidium. This effect was apparently not due to any toxic or allelopathic matter; when filtrates of a Phormidium culture were enriched and inoculated with Nostoc or Microcystis, there was no growth inhibition. Addition of Nutrients to the Phormidium filtrates showed that iron and trace metals were limiting; phosphorus and nitrogen were not lacking. Enrichment with iron and trace elements doubled Microcystis growth and increased Nostoc growth five times. Even in the absence of bacteria. Phormidium reduced the concentration of minor elements in the nutrient medium. This study showed that in a three-species algal system using a defined nutrient medium exhaustion of selected nutrient elements by one species may lead to exclusion of the other two species. (Buchanan-Davidson--Wisconsin) W76-03538

LAKE HAKOJARVI. A POLYHUMIC LAKE IN

SOUTHERN FINLAND, P. O. Lehmusluoto, and R. Ryhanen Verhandlugen Internationale Vereinigung Lim-nologie, Vol 18, p 403-408, 1972. 4 fig, 9 ref.

Descriptors: \*Lakes, \*Humus, Particle size, Iron, Phosphorus, Trophic level, Euphotic zone, Limiting factors, Light penetration, Primary productivi-

Identifiers: \*Lake Hakojarvi(Finland), Algal growth.

The humic components were of many sized fractions but the higher the humus concentration in the water, the higher was the proportion of large to small particles. Iron and phosphorus were found in large particles and calcium, magnesium, sodium, potassium, and manganese in small particles. The proportion of large:small particles increased with depth. In the laboratory algal growth increased with high humus concentrations, but light extinc-tion by humus and phytoplankton can decrease growth in lakes. Phytoplankton primary production varied during the year. Enrichment with urea and phosphate before spring circulation caused in-creased nitrogen, phosphorus, and phytoplankton primary production. Humus stimulated algal growth in the laboratory but had a restraining ef-fect in the lake, therefore this lake may be oligotrophic longer than a harmonic lake with equal enrichment. Nitrogen and phosphorus together may be limiting nutrients, as algal response was low with nitrogen or phosphorus alone. Autochtonous primary production is the energy source for heterotrophic life in polyhumic lakes. Glucose uptake increased when phytoplankton primary production increased. Glucose turnover time was about 200 hours in the epilimnion and 1000 hours in the hypolimnion. Oxygen was lacking in late injustifinion. Oxygen was inter; thus decomposition processes may be important in Lake Hakojarvi. (Buchanan-Davidson-Wisconsin) W76-03540

DISEASES TRANSMITTED BY FOODS CON-TAMINATED BY WASTE WATER, Center for Disease Control, Atlanta, Ga.

F. L. Bryan.

In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 16-45, 179 ref, 8 tab.

Descriptors: \*Waste water(Pollution), \*Water pol-Descriptors: "Waste water(Pollution), "Water pol-lution, "Human diseases, "Foods, Water reuse, Ir-rigation water, Aquiculture, Fish farming, Epidemics, Public health, Path of pollutants, Water pollution sources, Pollutants, Soil con-tamination, Food processing industry, Pathogenic bacteria, Pathogenic fungi, Sewage, Food chains, Publications, Reviews, Water pollution effects, Wastes Municipal waters Industrial wasters. Wastes, Municipal wastes, Industrial wastes.

Recycling wastewater for watering and nourishing food crops or for growing fish contributes to both food production and waste disposal. But when wastewater is used to irrigate crops or to provide water in aquaculture, appropriate precautions must be taken to prevent the diseases that might otherwise be transmitted by wastewater-con taminated foods. Foods can become contaminated during production either on farms or in watercourse, during processing in food processing plants, and during preparation in food service establishments and homes. The chain of events necessary for wastewater to contribute to foodborne outbreaks of human disease is reviewed, based on information from engineering and medical literature. The review covers pathogen survivals in sewage, in waste treatment processes, in receiving watercourses, during use of wastewater for irrigation, in soil, and in contaminated foods, as well as cross-contamination and multiplication during food processing, numbers of pathogens required to cause illness, and outbreaks of human illness associated with foods contaminated by sewage or wastewater. (See also W76-03541) W76-03544

EVALUATION OF MICRORIAL. PATHOGENS IN SEWAGE AND SEWAGE-GROWN FISH,

Oklahoma State Dept. of Health, Oklahoma City. R. L. Carpenter, H. K. Malone, A. F. Roy, A. L. Mitchum, and H. E. Beauchamp.

In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 46-55. 3 fig, 20 ref.

Descriptors: \*Sewage effluents, \*Pathogenic bacteria, "Viruses, "Fish, Waste water treatment, Water pollution sources, Water pollution treatment, Waste treatment, Municipal wastes, Bacteria, Lagoons, Sewage treatment, Aeration, Aerated lagoons, Coliforms, Aquatic microorganisms, Oklahoma.

Identifiers: Quail Sewage Creek Lagoon(Oklahoma), Hinde Air-Aqua System.

Studies showed that pathogenic bacteria and viruses were rare in sewage and sewage-grown fish from the Quail Creek Sewage Lagoon system (located near Oklahoma City, Oklahoma). The lagoon system consists of six cells and serves a residential district of approximately 10,000 persons producing approximately one million gallons of sewage/day. The first two cells are aerated with the conventional Hinde Air-Aqua System; the four following are operated in series at a level of four to five feet. This study confirmed the observations of previous investigators that indicator coliform organisms are efficiently removed in a lagoon-method waste water treatment system. (See also W76-03541) (Witt-IPC) W76-03545

MORBIDITY RISK FACTORS FROM SPRAY WITH TREATED WATERS

Texas Univ., Houston. School of Public Health. G. B. Stanford, and R. Tuburan. In: Wastewater Use in the Production of Food and Fiber - Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 56-64. 26 ref.

Descriptors: \*Sprinkler irrigation, \*Irrigation water, \*Water reuse, \*Human disease, \*Sewage effluents, \*Waste water disposal, Municipal

wastes, Publications, Reviews, Public health. Sewage, Wastes, Viruses, Diseases, Sewage treatment, Water pollution sources, Pollutants, Waste treatment, Anaerobic digestion, Sludge, Sewage sludge, Management, Treatment facilities, Irrigation, Waste disposal, Pathogenic bacteria.

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A literature search has not revealed any incidence of huma disease outbreaks from spray irrigation with effluent from properly treated sewage (receiving at least secondary treatment). It is pointed out that treatment by primary settling reduces the general pathogen load in the supernatant waters and carries most of the viral load into the sludge. Properly conducted aerobic treatment, whether by biological filter or by the activated sludge process, can reduce the non-viral pathogen load by better than 99%, although this is seldom achieved in practice. Disease outbreaks have been associated with primary settled sludge, but secondary anaerobic treatment of sludges in a plant which is not overloaded produces a sludge that is safe. While existing information does not warrant any restrictions on the use of properly treated waste waters for land application, it does support a case for careful management of sewage plants whose products are to be used in this way. (See also W76-03541) (Witt-IPC) W76-03546

PERMISSIBLE LEVELS OF HEAVY METALS IN SECONDARY EFFLUENT FOR USE IN A COMBINED SEWAGE TREATMENT-MARINE AQUACULTURE SYSTEM. I. MONITORING DURING PILOT OPERATION,

Woods Hole Oceanographic Institution, Mass.
W. B. Kerfoot, and S. A. Jacobs.
In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 65-78. 2 fig, 24 ref, 3 tab.

Descriptors: \*Water pollution effects, \*Heavy metals, \*Oysters, \*Shellfish, \*Aquiculture, Sewage effluents, Water pollution sources, Water pollution treatment, Zinc, Copper, Lead, Cadmi-um, Chromium, Nickel, Metals, Aquatic animals, Mollusks, Commercial shellfish, Algae, Aquatic algae, Toxicity, Taste, Foods, Public health, Pilot plants, Sewage, Domestic wastes, Fertilizers, Nutrients, Food chains. Identifiers: Crassostrea virginica.

Domestic waste water inherently contains a higher load of metals than the original source water, due to the treatment of water for algae control, leaching from pipes, and solutes added during household use. While nutrient-rich secondarily-treated waste water can serve as a fertilizer for aquaculture of commercially valuable algae and shellfish, excessive levels of metals in solution may be toxic to the cultured organisms, accumulate in the meat of food products to the extent of posing a danger to public health if consumed, or impair the visual appeal and taste of the meat. The levels of Cd, Pb, Cu, Zn, Cr, and Ni in secondarilevels of Cd, PD, Cu, Zn, Cr, and N1 in secondarily-treated waste water, seawater, and oysters (Crassostrea virginica) during operation of a pilot waste water-seawater aquaculture system were studied. The 102-day study indicated that while other potential contaminants, including pathogens and organic compounds, need further investiga-tion to evaluate the advisability of substituting secondary effluent for artificial media in aquaculture, the inherent elevated metal concentrations in domestic waste water do not appear to pose a threat to shellfish culture if effluent of a prin-cipally domestic source is used. (See also W76-03541) (Witt-IPC) W76-03547

PERMISSIBLE LEVELS OF HEAVY METALS IN SECONDARY EFFLUENT FOR USE IN A COMBINED SEWAGE TREATMENT-MARINE AQUACULTURE SYSTEM. II. DEVELOPMENT OF GUIDELINES BY METHOD OF ADDI-

Woods Hole Oceanographic Institution, Mass.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5 Effects Of Pollution-Group 5C

W. B. Kerfoot, and G. A. Redmann. In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 79-101. 7 fig, 23 ref, 2 tab.

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Descriptors: \*Heavy metals, \*Oysters, \*Water pollution effects, Water pollution sources, Sewage effluents, Water pollution treatment, Toxicity, Zine, Copper, Lead, Cadmium, Chromium, Nickel, Metals, Algae, Aquiculture, Model studies, Pollutants, Aquatic algae, Aquatic animals, Mollusks, Commercial shellfish, Shellfish, Food chains, Nutrients.
Identifiers: Phaeodactylum tricornutum, Crassos

trea virginica.

This study attempts to define the concentrations of Zn, Cu, Pb, Cd, Cr, and Ni that are permissible in a waste water-marine aquaculture system for culturing oysters (Crassostrea virginica). The oysters are cultured on algae (Phaeodactylum tricornutum) raised with secondarily-treated waste water substituted for artificial nutrients. The pathways of contamination and toxicity of the metals to the algae and overter are exceived and metals to the algae and oysters are reviewed and metals to the algae and oysters are reviewed and details are given of the experimental procedures. From the toxicity studies, levels of metal above 0.3, 0.5, 0.5, 0.5, 1.0, and 1.0 ppm, respectively, for Cu, Cd, Ni, Cr, Pb, and Zn may inhibit algal growth if present in the effluent and would appear udesirable. Few oysters died during the operation of the scale model waste water-aquaculture system, probably because of the high dilution of effluent before exposure to the oysters. An increase in the level of metals in the seameter/effluent media, in general caused a progression. water/effluent media, in general, caused a progressive rise in the content of metal in the tissue of the oysters being cultured. The clearest pattern of acoysters being cultured. The clearest pattern of ac-cumulation occurred in the elements of lesser af-finity for the oyster tissue, Cr, Ni, and Cd. The concentration of Pb showed a more abrupt rise than the other metals. Cadmium was the only ele-ment to show detectable accumulation at 0.03 ppm, but also appeared to saturate at the highest level (10 ppm). Some accumulation of Cu oc-curred, but no definite uptake of Zn could be discerned. Permissible levels of metals in a secon-dary effluent for use in a waste water-aquaculture dary effluent for use in a waste water-aquaculture system for raising oysters are given. (See also W76-03541) (Witt-IPC) W76-03548

REPORT ON PILOT AQUACULTURE SYSTEM USING DOMESTIC WASTEWATERS FOR REARING PACIFIC SALMON SMOLTS, Humboldt State Univ., Arcata, Calif. School of Natural Resources.

Natural Resources.
G. H. Allen, and L. Dennis.
In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 162-198. 9 fig, 38 ref, 9 tab.

Descriptors: \*Salmon, \*Sewage effluents, \*Pilot plants, \*Aquiculture, Fish, Water pollution control, Water pollution treatment, Sea water, Aquatic animals, Animal growth, Chinook salmon, Smolt, Domestic wastes, Mortality. Identifiers: Oncorhynchus kisutch, Oncorhynchus

tshawytscha, Coho salmon.

This report presents results of 6 salmon-rearing experiments in seawater-sewage effluent mixtures. Four experiments involved short-term rearing of fingerling coho salmon (Oncorhynchus kisutch) during summer through late-fall periods, and two experiments involved rearing of chinook salmon fry (O. tshawytscha) during 3-4 months of winter-spring growing periods. A description is given of the pond system and its operation. Results are reported in terms of survival and growth. The production of salmon from the system varied production of salmon from the system varied widely. For coho fingerling planted in late summer and fall periods the trend was from moderate to high survivals, coupled with an inverse trend in actual fish production (high to low). The single ex-periment with coho fingerlings reared during a summer period showed a low survival and low production of salmon but a high survival and high production of other species of fish. Both survival and production of chinook salmon from fry plantings were low, although the chinook grew fast and smolted. Factors causing mortalities are discussed, along with evaluation of the results. (See also W76-03541) (Witt-IPC)

AN EXPERIMENT IN THE EUTROPHICATION OF TERRESTRIAL ECOSYSTEMS WITH SEWAGE: EVIDENCE OF NITRIFICATION IN A LATE SUCCESSIONAL FOREST, Brookhaven National Lab., Upton, N.Y. G. M. Woodwell, J. Ballard, J. Clinton, M. Small,

G. M. WOOUWEII, J. Bahard, J. Californ, and E. V. Pecan.
In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 215-228. 5 fig, 17 ref, 2 tab.

Descriptors: \*Sewage effluents, \*Eutrophication, \*Ecosystems, \*Nitrification, \*Forests, Mixed forests, Coniferous forests, Pine trees, Oak trees, Sprinkler irrigation, Groundwater, Nutrients, Nitrates, Nitrogen, Plant groupings, Irrigation effects, Sewage treatment, Water pollution control, Water pollution treatment, New York, Percolation, Fertilizers, Soil disposal fields.

Identifiers: Timothy grass(Phleum pratense), Quercus alba, Quercus coccinea, Pinus rigida,

Primary treated sewage and secondary treated sewage were applied to a field of timothy (Phleum pratense), an abandoned field, a 25-year-old pine (Pinus rigida) forest, and an oak-pine (Quercus alba, Q. coccinea, P. rigida) forest on long Island by spray irrigation. Percolation into the groundwater from the mature late successional oak-pine water from the mature late successional oak-pine forest is normally low in major nutrients, especially nitrate-nitrogen. The agricultural communities and plant communities of early succession are leaky by comparison. The conversion of ammonium-ion nitrogen to nitrate occurred in the oak-pine forest during winter but not in the pine forest. There is little question that natural and agricultural communities can be used to treat sewage. However, any treatment system will require more than one plant community but there is little basis at one plant community but there is little basis at present for speculation as to the combinations that will prove most useful. (See also W76-03541) (Witt-IPC) W76-03555

IRRIGATION OF TREES AND CROPS WITH SEWAGE STABILIZATION POND EFFLUENT IN SOUTHERN MICHIGAN, Williams and Works, Grand Rapids, Mich. J. C. Sutherland, J. H. Cooley, D. G. Neary, and

In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 295-313. 1 fig, 8 ref, 9 tab.

Descriptors: \*Sewage effluents, \*Irrigation effects, \*Deciduous trees, \*Coniferous trees, \*Forestry, Ash trees, Cottonwoods, Oak trees, White-cedar trees, Plant growth, Waste water disposal, Michigan, Forests, Coniferous forests, Coniferous forests, Deciduous forests, Red pine trees, Irrigation, Trees, Nitrogen compounds, Phosphorus compounds, Irrigation water. Identifiers: Pinus resinosa, Populus deltoides x P. nigra, Populus canescens x P. grandidentata, Fraxinus pennsylvanica var. lanceolata, Liriodendron tulipifera, Thuja occidentalis, Larix decidua, Larix leptolepis, Quercus borealis.

The use of pond-stabilized sewage waste water for irrigation of hardwood and conifer plantings in southern Michigan has produced several distinct results after two years of treatment. Water quality monitored beneath a 20-year-old red pine (Pinus resinosa) plantation indicated 83-92% renovation of N, and 96% removal of P. Nitrate-nitrogen levels were greater under irrigation rates of 50 and

88 m/week than under 25 mm/week, but have remained below 1 mg/liter. The length and dry weight of red pine needles increased by as much as 36 and 56%, respectively, over those of unirrigated controls. Increases in diameter and height growth were not observed but are anticipated. Irrigation increased the survival and height growth of hardwood cuttings and seedlings. A cottonwood hybrid (Populus deltoides x P. nigra), an aspen hybrid (Populus canescens x P. grandidentata), and green ash (Fraxinus pennsylvanica var. lanceolata) exhibited the most dramatic responses to irrigation, growing an average of 112, 69, and 36 cm, respectively, in one year. Tulip poplar (Liriodendron tupifera) and white-cedar (Thuja occidentalis), while producing less total growth, increased their growth by four and five times over the range of treatments. Irrigation produced moderate ingrowth by four and five times over the range of treatments. Irrigation produced moderate in-creases in height growth in European and Japanese larch (Larix decidua and L. leptolepis), but had lit-tle effect on red oak (Quercus borealis). (See also W76-03541) (Witt-IPC)

HYGIENIC EVALUATION OF EPOXY COM-POSITIONS INTENDED FOR USE IN WATER

SUPPLY, (IN RUSSIAN),

Kalinichenko. Gig Sanit, 12: 81-82, 1974.

Descriptors: Water supply, \*Public health, Filters, Resins, \*Epoxy resins, Water quality, Water pollution effects, \*Path of pollutants, \*Lethal limit, Water quality standards, Rodents. Identifiers: Acetone, Amines, Chlorohydrin compounds, Compositions, Propane.

The effects on water quality of water-main filters made of epoxy resin were studied. The migration of epichlorohydrin, polyethylene polyamine (PEPA), diphenylolpropane, dibutyl phthalate and acetone into the water was determined. The maximum tolerance and abolute lethal doses of an aqueous solution and pure PEPA for rats and mice were determined. The recommended maximum allowable concentrating of PEPA is 0.15 mg/l lowable concentration of PEPA is 0.15 mg/l.— Copyright 1975, Biological Abstracts, Inc. W76-03561

THE DIALECTICS OF A PROPOSAL ON BIOLOGICAL CONTROL OF EUTROPHICATION IN SEWAGE LAGOONS,

National Taiwan Univ., Taipei.

In: Wastewater Use in the Production of Food and Fiber-Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 417-434. 2 fig, 31 ref, 1 tab.

Descriptors: \*Sewage lagoons, \*Fish stocking, \*Water purification, \*Biocontrol, \*Eutrophication, Fish, Aquatic animals, Water pollution treatment, Water pollution control, Waste water treatment, Waste treatment, Water quality control, Biological treatment, Municipal wastes, Sewage treatment, Proteins, Stocking.

Existing lagoons for the deposition of municipal sewage face the problems of extreme eutrophication and of discharging polluted effluents into public waters. Mechanical purification is too expensive. A proposal is made to stock the lagoons with fish (plankton-feeding fishes, filamentous algae eaters, bottom feeders, and scavengers) to purify the sewage water. In addition to puriyfing the sewage water, the fish can be harvested as a source of animal protein. (See also W76-03541) (Witt-IPC)

THE FEASIBILITY OF PENAEID SHRIMP CUL TURE IN BRACKISH PONDS RECEIVING TREATED SEWAGE EFFLUENT, North Carolina State Univ., Raleigh.

#### Group 5C-Effects Of Pollution

W. L. Rickards.

In: Wastewater Use in the Production of Food and Fiber--Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 504-512. 2 fig. 11 ref, 1 tab.

Descriptors: \*Water pollution effects, \*Shrimp, \*Brackish water, \*Sewage effluents, \*Aquiculture, Animal growth, Crustaceans, North Carolina, Aerated lagoons, Aeration, Water pollution treatment, Water pollution control, Dissolved oxygen, Hydrogen ion concentration, Water temperature, Stocking. Growth rates, Aquatic animals,

Identifiers: Penaeus setiferus.

Previous studies showed that juvenile white shrimp (Penaeus setiferus) survived and grew in ponds containing brackish tudal creek water failed to survive in ponds containing brackish water plus treated sewage effluent (sewage water plus treated the sewage ponds were ponds). In this study the sewage ponds were aerated and again stocked with shrimp. Aeration maintained dissolved oxygen well above the minimum desirable level of 3 mg/liter. Aeration had no detectable effect on water temperature, but diurnal fluctuations in pH were moderated. The shrimp survived and grew well in the aerated ponds, gaining 13.4 grams in approximately 70 days or 0.97 mm in length per day. Such growth compares favorably to that of shrimp in natural populations in North Carolina. (See also W76-03541) (Witt-IPC) W76-03573

STANDING CROPS OF BENTHIC FAUNA IN MARINE AQUACULTURE PONDS USING RECLAIMED WATER.

Humboldt State Univ., Arcata, Calif.

T. R. Sharp.

In: Wastewater Use in the Production of Food and Fiber--Proceedings, March 5-7, 1974, Oklahoma, City Oklahoma, p 513-528. 2 fig, 17 ref, 6 tab.

\*Benthic fauna, Descriptors: \*Aquiculture. \*Water pollution effects, \*Standing crops, \*Sewage effluents, Water pollution sources, Mud, Sands, Gravels, Oysters, Estuarine environment, Sea water, Amphipoda, Daphnia, Aquatic popula-tions, Fish, Fish food organisms, Aquatic life, Benthos, Worms, Reclaimed water, Brackish water, Tidal effects, Bottom sediments.

Identifiers: Shells, Capitella capitata, Polydora

ciliata, Anisogammerus confervicolus, Corophium spinicorne, Polychaete.

Comparisons were made of the benthic fauna growing on mud, sand (Hookton soil), river-run gravel, and ovster shells in an unfertilized pond (estuarine pond tidally flushed every 2-3 weeks) and a fertilized pond (static seawater-sewage effluent mixture). The organisms found in the ponds included two species of polychaete, Capitella capitata and Polydora ciliata, and two species of gammarid amphipod, Anisogammerus confervicolus and Corophium spinicorne. Daphnia species shells were found in large numbers but were considered artifacts. Other species occurred in low numbers. Both P. ciliata and A. confervicolus had significantly higher populations in the fertilized significantly higher populations in the fertilized pond than in the unfertilized pond. C. capitata and C. spinicorne standing crops did not differ between ponds, with C. capitata having large populations and C. spinicorne having extremely low populations. Only C. capitata and A. confervicolus varied with substrate; C. capitata had the largest populations on sand and A. confervicolus capitate ways. In second capitate ways. populations were largest on oyster shell and gravel. The changes in fauna with time and the effects of fish on fauna populations are also discussed. Population of the fish food fauna, such as A. confervicolus, could conceivably be increased by covering the mud substrate (and per-haps even the sand) with oyster shells or gravel. (See also W76-03541) (Witt-IPC) W76-03574

CONTROLLED EUTROPHICATION: SEWAGE TREATMENT AND FOOD PRODUCTION, Texas Univ. Medical Branch at Galveston.

For primary bibliographic entry see Field 5D.

THE TUXTEPEC PAPER MILL (OAXACA, MEXICO) AND POLLUTION OF THE PAPALOAPAN RIVER (LA FABRICA DE PAPEL TUXTEPEC Y LA CONTAMINACION DEL RIO PAPALOAPAN), Fabricas de Papel Tuxtepec, S.A., Oaxaca

I. Montelongo, and G. Ortiz y Leon

ATCP (Asociacion Mexicana de Tecnicos de las Industrias de la Celulosa y del Papel), Vol 15, No 4, p 195-204, July/August, 1975. 8 fig, 4 ref, 7 tab, English summary.

Descriptors: \*Pulp wastes, \*Water pollution, \*Mexico, Foreign countries, Water pollution sources, Wastes, Industrial wastes, Biochemical oxygen demand, Rivers, Water quality standards, Sewage treatment, Waste water treatment, Waste treatment, Pulp and paper industry.

Identifiers: Newsprint, Bleached pulp, Chemical

pulp, Mechanical pulp, Zinc dithionite, Fiber recovery, Papaloapan River(Mexico).

The characteristics of effluents discharged into the Papaloapan River from the Tuxtepec Paper Mill are tabulated. The Tuxtepec mill produces 165 tons/day of newsprint from 21% semibleached chemical pulp and 79% mechanical pulp. Zinc dithionite is the principal bleaching agent used. The characteristics of the river water, including BOD levels, are also tabulated. At present the mill is studying means of meeting pollution control standards with a primary treatment system which would also serve as a fiber recovery system. (Sykes-IPC) W76-03577

EFFECT OF ZINC ON THE MOVEMENT PAT-TERN OF THE MINNOW PHOXINUS PHOX-INUS L.,

Umea Univ. (Sweden). Dept. of Biology. B. E. Bengtsson.

Water Research, Vol 8, p 829-833, 1974, 3 fig, 1 tab. 17 ref.

Descriptors: \*Heavy metals, \*Zinc, \*Minnows, Aquatic life, Aquatic environment, \*F, behavior, \*Fish toxins, Water pollution effects. Identifiers: \*Phoxinus phoxinus L.

A shoal of 30 minnows, Phoxinus phoxinus L., was studied to determine the effects of sublethal concentrations of zinc on their behavioral patterns. After an initial 24 day control period, Zn(NO3)2 was added as a solution in distilled water and diluted about 100 times by a dosing apparatus. The concentration was raised successively for six days and then kept at 0.38-0.39 ppm zinc for 9 days. The dosing was then stopped and the concentration of zinc decreased gradually to its initial value. The results indicate that the addition of zinc produces an initial period of hyperactivity which occurs within 3 days of the first dose of zinc. This behavior is followed by a period of hypoactivity. There were also changes in the dishypoactivity. Here were and changes in the distribution between diurnal and nocturnal activity. The possible causes and further reaching consequences of such behavioral changes are discussed. (Hoyle-Vanderbilt) W76-03582

POTENTIAL EFFECTS OF AQUACULTURE ON INSHORE COASTAL WATERS, Virginia Univ., Charlottesville. Dept. of Environ-

mental Sciences.

Environmental Conservation, Vol 1, No 3, p 225-230 (Autumn 1974). 6 p., 33 ref.

\*Aquiculture, cts. \*Diseases, Descriptors: \*Eutrophication, \*Aquiculture, \*Effluents, \*Environmental effects, \*Diseases, Sediment discharge, Sedimentation, Plankton, Ox-Sediment discharge, Sedimentation, Plankton, Ox-ygenation, Microorganisms, Ponds, Benthos, Algal toxins, Biochemical oxygen demand, Regu-lations, Habitats, Water quality control, Fish farming, Estuaries, Fish hatcheries, Toxins, Dredging, Marshes, Parasitism. Identifiers: \*Introduction of exotic organisms,

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\*Raft culture, Walking catfish, Hazardous sub-stances(Pollution).

Construction and operation of aquaculture facilities generates a wide variety of environmental effects, some of which are potentially harmful. Frequently encountered detrimental results of aquaculture are surveyed. These include: (1) changes induced in native animal and plant populations; (2) pH changes in water used; (3) lower dissolved oxygen concentrations; and (4) increased biochemical oxygen demand (BOD). Another frequent problem is sedimentation, especially in culturing of oysters and mussels. Perhaps the most dangerous side effects, however, arise with the introduction of exotic organisms to environments not capable of controlling them. The takeover of Florida's inland waters by tropical fish imported from other countries, and new disease strains which are hazardous to native organisms and to man are prime examples. While there are regulations controlling aquaculture, the aquaculture in-dustry has successfully resisted regulating efforts in some areas. (Parrish-Florida) W76-03585

MICROBIAL-MALATHION INTERACTIONS IN ARTIFICIAL SALT-MARSH ECOSYSTEMS: EF-FECT AND DEGRADATION,

Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab. For primary bibliographic entry see Field 5B. W76-03634

THE DESIGN OF A MARINE ENVIRONMEN-TAL SIMULATION SYSTEM,
Data Industries Inc., East Providence, R. I. Ocean

Data Equipment Div. For primary bibliographic entry see Field 5B. W76-03643

EFFECTS OF SUSPENDED SOLIDS AS-SOCIATED WITH DREDGING OPERATIONS ON ESTUARINE ORGANISMS, Army Engineer District, San Francisco, Calif.

T. Wakeman, R. Peddicord, and J. Sustar. IEEE Ocean '75 Record, p 431-436, 1975. 4 fig, 2 tab. 6 ref.

Descriptors: \*Sediments. \*Suspended solids. Disposal, \*Dredging, Benthic Ecosystems, Temperature, Dissolved oxygen, Water pollution effects.

The suspended solids concentrations during various dredging and disposal operations in San Francisco Bay were monitored. The results were integrated with the results of a suspended solids test performed at the Bodega Marine Laboratory to develop a matrix of potential adverse effects on indigenous organisms under various suspended solids loadings. The matrix indicated that under winter conditions of low temperature and high dissolved oxygen adults of most species should not be adversely influenced during periods of either dredging or disposal. However, during summer months, if temperature increased to above 18C and dissolved oxygen dropped below 2 ppm, mortality of sensitive species in the lower water colume could result during disposal operations. (Klein) W76-03645

COMPARATIVE UPTAKE POLYCHLORINATED BIPHENYL AND DIEL DRIN BY THE WHITE SUCKER (CATAOSTOMUS COMMERSONI), Michigan Univ., Ann Arbor. School of Natural SUCKER

Pesources L. L. Frederick.

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alif. . 4 fig, 2 Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1705-1709, 1975. 1 fig, 2 tab, 7 ref.

Descriptors: \*Suckers, \*Chlorinated hydrocarbon pesticides, \*Dieldrin, Aroclors, \*Polychlorinated biphenyls, Uptake, Metabolism, Toxicity, Path of biphenyis, Uptake, Metadousin, Ioanay, rain or pollutants, Analytical techniques, Fish physiolo-gy, Water pollution effects. Identifiers: "White suckers, "Catostomus com-mersoni, "Aroclor 1232, "Bioaccumulation, Tissue

White suckers (Catostomus commersoni) accumulated the PCB Aroclor 1232 and dieldrin from water at approximately the same rate. However, they accumulated higher PCB levels than dieldrin levels when exposed to equivalent concentrations levels when exposed to equivalent concentrations of these substances. The uptake pattern of Aroclor 1232 components on a whole fish basis and in gill and intestinal tissue was similar to Aroclor 1232 components to which the fish were exposed. The presence of additional components having short chromatographic retention tissues was observed in liver, brain, and kidney tissues in fish exposed only to Aroclor 1232. (Klein) W76-03646

THE LETHAL AND SUBLETHAL EFFECTS OF A ZIRCONIUM PROCESS EFFLUENT ON JU-VENILE SALMONIDS,

Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.

and Widdle. E. F. Robinson-Wilson, and W. K. Seim. Water Resources Bulletin, Vol 11, No 5, p 975-986, October 1975. 5 fig, 2 tab, 18 ref.

Descriptors: \*Salmonids, \*Coho salmon, \*Chinook salmon, Effluents, \*Ammonium compounds, \*Toxicity, Chlorides, Ammonia, Juvenile growth stage, Growth rates, Water quality, Lethal limit, Water pollution effects.

ldentifiers: Oncorhynchus tshawytscha, Oncorhynchus kisutch, Ammonium chloride, \*Zirconium process effluents.

An effluent (ZPE) with high concentrations of ammonia was compared with solutions of ammonium chloride in both lethal and sublethal tests on juvenile solmonids (Oncorhynchus tshawytscha and O. kisutch). The ZPE was more toxic than were solutions of ammonium chloride in acute toxicity tests, although ammonia was shown to be the major toxicant. Growth was used as a sublethal test parameter and ZPE was again more toxic than ammonium chloride solutions at the same ammonia concentrations. Concentrations of ammonia less than 3 mg/liter in ammonium chloride solu tions actually stimulated the growth of juvenile chinook salmon. (Klein)

THE SIGNIFICANCE OF DIISOCYANATE STA BILITY IN WATER IN HYGIENIC STAN-DARDIZATION, (IN RUSSIAN), Ministerstvo Zdravookhraneniya S.S.S.R.

Ministerstvo Zdravook Moscow. Institut Biofiziki.

For primary bibliographic entry see Field 5B. W76-03648

POTAMOLOGICAL EFFECTS OF FISH HATCHERY DISCHARGE, Saint Mary's Coll., Winona, Minn. A. T. Szluha.

Trans Am Fish Soc. 102(2): 226-234. Illus. 1974.

Descriptors: \*Fish hatcheries, \*Michigan, \*Periphyton, \*Waste water treatment, Oxygen, \*Settling resins, Nitrogen, Phosphorus, Potamology, Water pollution effects.

Identifiers: Jordan River(Mich), \*Fish hatery

The ecological impact of fish hatchery wastes on periphyton production rates and O2 balance were determined in the Jordan River from March through June, 1971 and 1972. The hatchery, located in the Jordan Valley, utilizes 2 systems of tributary springs for its water supply. Until spring 1972 the hatchery was discharging its untreated wastes into the Jordon River but during winter, 1971 and 1972, 2 settling basins were built to remove 80-95% of setteable solids from the wastewater. The Jordan Valley National Fish Hatchery discharged the approximate equivalent of 898 kg of elemental P and 4170 kg of elemental N between July 1970 and June 1971, and 998 kg of P and 4604 kg of N between July 1971 and June 1972. These quantities comprised approximately 28% and 5% of the annual load of P and N, respectively, in the Jordan River at the vicinity of the hatchery. Periphyton production rates increased exponentially during the study periods. Mean production rates were 7 times greater below the outfall than at the control stationabove the discharge in 1971 and 5 times greater in 1972. Although periphyton production rates were increases below the outfalls, Q2 balance was not affected significantly by the hatchery effluent, either before or after instal-Copyright 1974, Biological Abstracts, Inc. W76-03650

HISTORICAL CHANGES IN MERCURY CON-TAMINATION IN MICHIGAN WALLEYES (STIZOSTEDION VITREUM VITREUM), Michigan Univ., Ann Arbor. Great Lakes Resource Management Program. For primary bibliographic entry see Field 5B.

W76-03652

ENVIRONMENTAL FACTORS AFFECTING
THE STRENGTH OF WALLEYE
(STIZOSTEDION VITREUM VITREUM) YEARCLASSES IN WESTERN LAKE ERIE, 1960-70, Bureau of Sport Fisheries and Wildlife, Sandusky, Ohio. Biological Station.

W-D. N. Busch, R. L. Scholl, and W. L. Hartman. Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1733-1743, 1975. 6 fig, 4

Descriptors: Freshwater fish, \*Commercial fishing, \*Environmental effects, \*Fish reproduction, Spawning, Heated water, Temperature, Life cycles, Currents(Water), Biomass, Productivity, Annual turnover, \*Walleye, \*Lake Erie, Lakes. Identifiers: Year-classes.

Commercial production of walleyes (Stizostedion vitreum vitreum) from western Lake Erie declined from 5.9 million pounds in 1956 to 140,000 pounds by 1969. Since 1956, marked irregularity in yearclass success has developed. Only four year-classes were considered good during 1959-70. The rate and regularity of water warming during the spring spawning and incubation periods in 1960-70 has a positive effect on the density of egg deposits and the resulting year-class strength. Rates of warming were not themselves detrimental, but rather the extended length of the incubation period in cool springs increased the exposure of eggs to such negative influences as dislodgement from the spawning reefs by strong current action generated by spring storms, or siltation and low oxygen ten-sions. The annual brood stock size had much less influence on year-class strength than did water temperature. Reproductive success was unrelated to fluctuations in size of suitable reef spawning area caused by changes in water level. Apparently the usable spawning area at any water level was more than adequate to serve the limited walleye brood stocks. (Klein) W76-03653

SIGNIFICANCE OF DETRITUS OR DETRITUS-

ASSOCIATED INVERTEBRATES TO FISH PRODUCTION IN A NEW IMPOUNDMENT, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and, Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.

D. S. Cherry, and R. K. Guthrie.

Journal of the Fisheries Research Board of

Canada, Vol 30, No 10, p 1799-1804, 1975. 2 fig, 1

Descriptors: \*Detritus, \*Fish diets, \*Growth rates, Nutrient requirements, Biomass, Sediments, Invertebrates, Cladophora, Copepods, Diptera, Sunfishes, Carp, Bullheads, Bass, Primary productivity, Impoundments.
Identifiers: \*Food sources, \*Feeding habits, Coleopterans, Pickeral, Cyprinus carpio, Ictalurus platycephalus, Micropterus salmoides, Esox niger.

During early stages of succession in a new impoundment, fish species that could assimilate the readily available food resources, i.e. carp (Cyprinus carpio) and flat bullhead (Ictalurus (Cyprinus carpio) and flat builhead (Ictaiurus platycephalus) were initially favored in numbers and weight. Detrital feeders or amnivores represented by carp and the flat builhead comprised a majority of the numbers (56%) and weight (65%) of the 25 species captured during a 2-yr period. Numbers of the major fish groups captured decreased from 1971 to 1972, while the weight per research increased. On a solventic hearing factories species increased. On a volumetric basis, detritus detritus-associated invertebrates and detritus-associated invertebrates (coleopterans and dipterans) were the major food items consumed by carp and catfish. Relative abundance of animal food items, in terms of frequency of occurrence and percentage of stomach contents, was greater at warmer water temperatures. In comparison to other species, catfish contained the greatest diversity of food items during warmer months and consumed larger quantities of detritus in the winter. Fish groups that constituted a smaller biomass, such as centrarchids, were generally insectivorous or fed upon cladocerans and copepods, while adult bass (Micropterus salmoides) and (M. coosae) and chain pickerel (Esox niger) were piscivorous. (Klein) W76-03654

YELLOW PERCH (PERCA FLAVESCENS)
BIOMASS RESPONSES TO DIFFERENT
LEVELS OF PHYTOPLANKTON AND
BENTHIC BIOMASS IN LAKE
MEMPHREMAGOG, QUEBEC-VERMONT,
McGill Univ., Montreal (Quebec). Dept. of Biolo-

By. S. Nakashima, and W. C. Leggett.

Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1785-1797, 1975. 6 fig, 7

Descriptors: \*Perches, \*Biomass, \*Productivity, Benthos, \*Phytoplankton, Nutrient requirements, Life cycle studies, Ecosystems, Population, Growth rates, Size, \*Canada, Vermont, \*Yellow perch, \*Benthos.
Identifiers: \*Lake Mamphremagog(Quebec).

Yellow perch (Perca flavescens) biomass in Lake Memphremagog, Quebec, was 2.5 times greater in the more productive south than in the north basins which correlated with the biomass differences in the phytoplankton (1.6 times) and benthic (3x) communities. Growth was similar in both basins and independent of production at the lower trophic levels. Perch growth in both basins was though to be controlled by the length of the growing season. Abundance levels were fixed by the fourth year and possibly prior to reaching the second year of life. Perch biomass responses to different food levels provided empirical support to Moore's (1941) suggestion that at abundant food levels, population size and not growth is enhanced. (Klein) W76-03655

#### Group 5C-Effects Of Pollution

UPTAKE AND LOSS OF PETROLEUM HYDROCARBONS BY THE MUSSEL, MYTILUS EDULIS, IN LABORATORY EXPERI-MENTS, National Marine Fisheries Service, Seattle, Wash.

For primary bibliographic entry see Field 5A.

EPIZOOTIOLOGY OF TUMORS IN A POPULA-TION OF JUVENILE ENGLISH SOLE (PAROPHRYS VETULUS) FROM PUGET SOUND, WASHINGTON,

Washington Univ., Seattle. Fisheries Research Inst.

C. L. Angell, B. S. Miller, and S. R. Wellings. Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1723-1732, 1975. 2 fig. 4

Descriptors: \*Marine fish, \*Fish diseases, Juvenile growth stage, Sampling, Analytical techniques, Life cycles, Seasonal, Fish genetics, Fish parasites, Nutrient requirements, Life history Pish parasites, Nutrient requirements, the mastry studies, Fish physiology, Epidermis, \*Washington, Water pollution effects. Identifiers: \*English sole, \*Parophrys vetulus, \*Epizotiology, Tumors, Tissue analysis, Angioepithelial nodules, \*Puget Sount(Wash).

An epizootic skin tumor disease affected youngof-the-year English sole (Parophrys vetulus) near Seattle, Wash. The 1969 year-class had an incidence of 18.7%. The epizootic wave began in August and peaked in October. Incidence rapidly declined thereafter. The disease coincidentally attacked winter and summer influxes. There was no difference in growth between age-group 0 normal and tumorous fish, but age distribution of tumorous fish indicated longevity differed. Tumors were more numerous on younger fish. An-gioepithelial nodules grew until transforming into epidermal papillomas, which reached maximum weight in age-group II. There were no differences in sex ratios between normal and tumorous fish. W76-03657

PLANKTONIC ECOSYSTEMS. THE EFFECTS OF DYSTROPHIC CONDITIONS ON STRUC-TURE AND FUNCTION IN THE GULF OF FOS CECOSYSTEME PLANCTONIQUE. STRUC-TURE ET FONCTIONNEMENT EN RELATION AVEC DES PHENOMENES DE DYSTROPHIE (GOLFE DE FOS)),

Centre Universitaire de Luminy, Marse (France). Laboratoire d'Hydrobiologie Marine. F. Blanc, M. Leveau, and M-C. Bonin.

Internationle Revue der gesamten Hydrobiologie, Vol 60, No 3, p 359-378, 1975. 20 fig., 4 tab., 23 ref.

Descrip ors: \*Effluents, \*Dystrophy, \*Plankton, \*Diatoms, \*Dinoflagellates, \*Ecosystems, Water quality, Aquatic microorganisms, Reproduction, Metabolism, Brackish water, Rivers, Life history studies, Biological communities, Trophic level, Water pollution effects.

Identifiers: Skeletonema costatum, Exuviaella. Prorocentrum, Acartia, \*Gulf of Fos(France).

Due to industrial and natural effluents from the Rhone and Durance rivers, unusual structure and dynamic behavior were exhibited by the plankton ecosystem. The ecosystem was kept at a low state of maturity, which was characterized by frequent periods of intense multiplication by small species with high metabolic rates. These species include the diatom, Skeletonema costatum, and the dinoflagellates Exuviaella and Prorocentrum. Brackish water seemed condusive to this type of proliferation. The turnover rate of these populations decreased with age and increse in cell size was evident. The lack of competition by species of the same genus was characteristic of the photo-autotrophic organisms in these environments. Secondary production followed the same cycle as the primary production by the dinoflagellates. Zooplankton species of the genus Acartia showed periods of intense development in these areas. (Klein) W76-03658

MAN-MADE EUTROPHICATION IN A NEW-FOUNDLAND (CANADA) HARBOUR, Queens Univ., Kingston (Ontario). Dept. of Biolo-

M. F. Frecker, and C. C. Davis.

Internationale Revue der gesamten Hydrobiologie, Vol 60, No 3, p 379-392, 1975. 6 fig, 2 tab, 53 ref.

Descriptors: \*Eutrophication, \*Phytoplankton, "Nanoplankton, Sewage, Euglena, Harbors, Water pollution effects, Water quality, Primary productivity, Biomass, Salinity, Temperature, Oxygen, Sampling, Bioindicators, "Canada. Identifiers: "St. John's Harbour(Newfoundland).

comparative study in 1969-1970 of the John's Harbour and Aquaforte Harbour, located on the southeast coast of Newfoundland, led to the conclusion St. John's Harbour which receives untreated sewage as a prime source of nutrients was by far the more eutrophic. Evidence for the eutrophic state was especially observed in the cen-tral basin of the harbour. Here the bottom waters were deficient in oxygen especially during the summer months. Secchi disc readings were generally lower at this station, and the annual standing crop of phytoplankton was almost three times that at unpolluted Aquaforte Harbour. Also the proportion of the biomass contributed by the nanoplankton was greater in St. John's Harbour. One euglenoid occurred in bloom concentrations throughout the summer months and may possibly be considered as an indicator of organically-pol-luted waters. (Klein)

EFFECTS OF A SANITARY LANDFILL ON GROUNDWATER QUALITY IN ASHLAND, NEW HAMPSHIRE,

New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.

P. B. Briggs. Master's Thesis, September 1974. 55 p, 15 fig, 10 tab, 20 ref, append.

\*Water pollution, \*Groundwater, Descriptors: \*\*Landfills, \*New Hampshire, Solid wastes, Alluvial aquifers, Soil water, Water quality, Leaching, Leachate, Path of pollutants, On-site investigations, Sampling, Water analysis, Chemical analysis, Oxygen demand, Dissolved solids. Identifiers: \*Wool wastes, \*Ashland(NH).

A study of the effect of landfill leachate on the groundwater quality under a landfill was begun in 1972 in Ashland, New Hampshire. Water samples were taken from the unsaturated zone with vertically stacked suction lysimeters, and from the groundwater by observation wells. Field measure-ments included water level in the observation wells, temperature, electrical conductivity, and pH. Laboratory measurements were made of pH, electrical conductivity, total Fe, Ca, Mg, Na, K, HC03, S04, C1, N03, total P04, BOD, and COD. The landfill had minimal effect on the groundwater quality of the site during the first 16 months of operation. Concentrations of the chemical parameters were low; for example, chlorides never exceeded 30 mg/1, nitrates were consistently less than one mg/1, intrates were consistently less than one mg/1, and there was essentially no BOD and COD. However, dissolved solids in the soil water increased slightly with time, and the beginning of an upward trend was noted in two ob-servation wells. Wool wastes deposited in the landfill by a local woolen mill may be a significant radium by a local woolen mill may be a significant factor in retarding the leachate movement to the groundwater. Filtering action of the wool may also be playing a major role in renovation process of the leachate. The wool wastes have a high porosity, low permeability, and a high field capacity. (Gibb-ISWS) W76-03721

THE ECOLOGY OF SUBLITTORAL COMMIL NITIES AT ABEREIDDY QUARRY, PEMBROKESHIRE,

University Coll. of North Wales, Bangor. Dept. of Marine Biology.

K. Hiscock, and R. Hoare

Journal of the Marine Biological Association of the United Kingdom, Vol 55, p 833-864, 1975. 4 fig, 5 tab, 57 ref.

Descriptors: Communties, \*Distribution patterns, \*Ecosystems, \*Biological communities, Speciation, Bodies of water, Bays, Sediments, Currents(Water), Rhodophyta, \*Litoral. Identifiers: \*Sublittoral communities, Bispira volutacornis, Ascidia mentula, Halopteris filicina, Estatical Programments of the Programment of t

Echinoderms, Barnacles, Bryozoa, Suspension,

During the summer months at Abereiddy Quarry, a saline marine basin, there was a marked thermocline at 12-14m below which water was 4 degrees C colder, had a lower light transmittance, was deoxygenated and had a high level of hydrogen sulphide. Above the thermocline, rock surfaces were characterized by a small number of species common within the quarry but not observed, or rare, outside. Compared with the open coast, the fauna of the quarry showed a reduction in the abundance and variety of erect bryozoa, barnacles and echinoderms together with the absence of many hydroids and of Alcyonium digitatum. Within the quarry an abundance of active suspension feeders was found. The laminarian forest and red algae found outside were absent from within the quarry, but some filament algae and Halopteris filicina were abundant. The lack of water movement within the quarry, which resulted in siltation and a lack of current-borne food for passive suspension feeders mainly accounted for the differences in speciation. Below 10m diversity was reduced. (Klein)

NATURAL FLUCTUATIONS IN A SOFT BOT-

TOM BENTHIC COMMUNITY, University Coll. of North Wales, Menai Bridge. Marine Science Labs.

R. A. Eagle.

Journal of the Marine Biological Association of the United Kingdom, Vol 55, p 865-878, 1975. 2 fig. 3 tab. 31 ref.

Descriptors: \*Surveys, \*Benthic fauna, \*Speciation, Population, Distribution patterns, Ecosystems, Biological communities, Dominant organisms, Sediments. Identifiers: Deposit feeders, Filter feeders, Pec-

tinaria koreni, Lanice conchilega, Abra alba.

Between 1970 and 1974 eight surveys were made of the benthic fauna in a coastal area. Dramatic variations were evident from survey to survey, especially in the muddy sand regions. Usually one three species (Pectinaria koreni, Lanice conchilega and Abra alba) was numerically dominant. Changes in dominant species, feeding types, and diversity were discussed and hypotheses were aggested in light of these fluctuations. (Klein)

BIOCONCENTRATION OF 2,2',4,4'-TETRACHLOROBIPHENYL IN RAINBOW
TROUT AS MEASURED BY AN ACCELERATED TEST,
Dow Chemical Co., Midland, Mich. Environmen-AN AC-

tal Sciences Research. D. R. Branson, G. E. Blau, H. C. Alexander, and

W. B. Neely. Transactions of the American Fisheries Society,

No 4, p 785-792, 1975. 3 fig, 3 tab, 19 ref.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5 Effects Of Pollution-Group 5C

Descriptors: \*Rainbow trout, \*Salmonids, \*Trout, Testing procedures, Methodology, Organic compounds, Fish physiology, Equilibrium, Kinetics, \*Polychlorinated biphenyls, Absorption. Identifiers: \*Tetrachlorobiphenyl,

\*Bioaccumulation, Tissue analysis.

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An accelerated test procedures for measuring the bioconcentration potential of chemicals in fish, based on kinetics, was developed using an isomer of PCB's: 2,2',4,4'-tetrachlorobiphenyl. The rates of uptake and clearance of the compound were determined by analysis of rainbow trout (Salmo gairdneri). The bioconcentration factor at steady-state uptake and clearance was determined by the accelerated test procedure and was compared to experimental observations in a 42-day test. The 42experimental observations in a 42-day test. The 42-day level was found to be 43% of the theoretical steady-state of the compound. This accelerated procedure was found to provide information concerning the potential of a chemical to bioconcentrate in fish in a much shorter time than previously described methods. (Klein) W76-03766

EFFECT OF AERIALLY-APPLIED MALATHION ON JUVENILE BROWN AND WHITE SHRIMP PENAEUS AZTECUS AND P.

Texas Agriculture Extension Service, College Sta-

Transactions of the American Fisheries Society, No 4, p 793-799, 1975. 1 fig, 4 tab, 13 ref.

Descriptors: \*Shrimp, \*Crustaceans, \*Pesticides, \*Marshes, Juvenile growth stage, Water quality, Saline water, Mortality, Pesticide residues, Water

pollution effects, Toxicity.
Identifiers: \*Penaeus aztecus, \*Penaeus setiferus,
\*Malathion, Bioaccumulation, Tissue analysis.

The effect of the standard serial application of malathion used in mosquito-control on juvenile brown and white shrimp, Penaeus aztecus and P. setiferus was examined in a saline marsh. Water settlerus was examined in a saline marsh. Water samples contained a high concentration of malathion immediately after application and a progressive reduction thereafter. Shrimp at treated stations exhibited mortalities ranging from 14-80%. Malathion concentrations in live shrimp taken from the test sites were consistently higher than those measured in dead shrimp removed in the same time period. (Klein) W76-03767

COMBINED EFFECTS OF CADMIUM AND SALINITY ON DEVELOPMENT AND SURVIVAL OF FLOUNDER EGGS, Biologische Anstalt Helgoland (West Germany). H. Von Westernhagen, and V. Dethlefsen.

Journal of the Marine Biological Association of the United Kingdom, Vol 55, p 945-457, 1975. 4 fig. 21sh 6f. ref. fig. 2 tab, 56 ref.

Descriptors: \*Marine fish, \*Salinity, \*Cadmium, \*Fish eggs, Toxicity, Embryonic growth stage, Water quality, Metals, Fish physiology, Water pollution effects.

Identifiers: \*Baltic flounder, Pleuronectes flesus, Hatching rates, Survival, Bioaccumulation.

Eggs of Baltic flounder (Pleuronectes flesus) were incubated in cadmium contaminated seawater (0.0-5.0 ppm) at four salinities (16, 25, 32, 42%). Effects of cadmium on embryonic survival and viable hatch were not dependent on the salinity of the incubating water. At all salinities hatching rates and viable hatch were not adversely affected by cadmium concentrations up to 1.0 ppm. Higher con-centrations up to 5.0 ppm caused marked decrease in hatching rates and viable hatch. Mean total length, eye and otic capsule diameter did not appear to be adversely affected by cadmium concentrations in the rearing medium. Cadmium content of eggs was generally higher in lower salinities than in more saline water of comparable cadmium concentrations. (Klein)

SMALL-SCALE CULTIVATION OF CELLS AND TISSUES FROM GOBID TELEOSTS, Bristol Univ. (England). Dept. of Zoology).

Journal of Marine Biological Association of the United Kingdom, Vol 55, p 933-938, 1975. 1 fig, 1

Descriptors: Methodology, \*Design, Analytical techniques, \*Teleosts, \*Fish physiology, Enzymes, Saline water, Laboratory tests, \*Cytological studies, Chromosomes. Identifiers: Pomatoschistus minutus, matoschistus microps, Tissue analysis.

A small-scale system was developed for culturing specific cells and tissue derived in restricted quanspecific cells and tissue derived in restricted quantities from the sand goby Pomatoschistus minutis and P. microps. Cell outgrowth was recorded from fin, skin, heart and spleen tissue of gobiid teleosts in media containing mammalian levels of sodium chloride, but media adjusted with 3-4 grams/liter of additional salt supported outgrowth from only fin and skin tissue. Suspensions of fin and gill cells were obtained by enzymatic digestion of tissue from an individual fish and were grown to confluence in salt-adjusted (fin and gill) or unadjusted (fin) media (Klein) (fin) media. (Klein)

ACID ROCK IN THE GREAT SMOKIES: UNANTICIPATED IMPACT ON AQUATIC BIOTA OF ROAD CONSTRUCTION IN REGIONS OF SUL-

FIDE MINERALIZATION,
Oak Ridge National Lab., Tenn. Environmental

Oak Ridge Platolial Law, Frank Sciences Div. J. W. Huckabee, C. P. Goodyear, and R. D. Jones. Transactions of the American Fisheries Society, No 4, p 677-684, 1975. 5 tab, 15 ref.

Descriptors: "Hydrogen ion concentration, "Acids, "Road construction, "Fishkill, Sediment control, Sulfides, Water quality, Salmonids, Toxicity, Brook trout, Mortality, Leaching, Salamanders, Path of pollutants, Metals. Identifiers: "Great Smoky Mountains National Park, Salvelinus fontinalis, Leurognathus marmoratus.

After the completion of a highway construction project in Great Smoky Mountains National Park in 1963, a fish kill was noted in a small stream draining an area of roadbed fill. After ten years, the stream remained devoid of fish for at least 8 km downstream from the fill. The downstream water a pH of 4.5 to 5.9; upstream from the fill the pH was 6.5-7.0. The rock material in the fill contains iron sulfide minerals. Other streams in the area flowing on the sulfide-rich rocks also showed low pH values. Survivability tests and stream surveys showed that brook trout could not tolerate conditions in the stream below the road fill or in a stream flow over natural outcrops of the same rock used in construction of the road fill. Native salamanders were also adversely affected downstream from the road fill. Chemical analyses of stream water and leaching tests indicated that lowered pH and increased sulfate and metals concentrations derived from the leaching of the sulfide-rich rocks were responsible for the trout and salamander mortalities. (Klein) W76-03770

A CRITICAL COMPARISON OF THE BIOLOGICAL ASSUMPTIONS OF HUDSON RIVER STRIPED BASS MODELS AND FIELD SURVEY

DATA, Power Authority of the State of New York.

D. N. Wallace. Transactions of the American Fisheries Society, No 4, p 710-717, 1975. 1 fig, 1 tab, 34 ref.

Descriptors: \*Striped bass, \*Powerplants, Legal aspects, Surveys, Population, Life cycles, Model studies, Distribution patterns, Water quality, \*Hudson River, \*New York. Identifiers: \*Morone saxatilis, \*Impact assessment, Biological assumptions.

In 1974 major decisions about the estimated impact of power plants along the Hudson River were reached by courts and regulatory agencies. These cases featured several striped bass (Morone sax-atilis) models as tools for impact assessment. Many of the models were based on assumptions relative to distribution, transport, and behavior of early life stages of striped bass. However, data from the 1965-1968 Hudson River Fisheres Investigation, the 1969-1970 Raytheon Survey, the 1971-1972 New York University ichthyoplankton study, the 1973 Texas Instruments Hudson River Fisheries Survey, and surveys in other striped bass estuaries did not support the assumptions of most of the models. Recommendations for use of models in decision-making were offered. (Klein) W76-03771

REPOPULATION OF AN ERADICATED STREAM SECTION BY BROOK TROUT, Montana Fish and Game Dept., Helena.

D. E. Phinney.
Transactions of the American Fisheries Society. No 4, p 685-687, 1975. 1 tab, 4 ref.

Descriptors: \*Salmonids, \*Brook trout, Popula-tion, \*Rotenone, Fish control agents, Propogation, Life cycles, Sampling, Habitat, \*Bioindicators. Identifiers: \*Repopulation, \*Electrofishing.

The rate of repopulation of a stream section treated with rotenone was studied by electrofishing. Brook trout (Salvelinus fontinalis) from the unaffected areas upstream had completely repopulated the area after one year. The primary repopulation was by young-of-the-year trout. (Klein) W76-03772

THE EFFECT OF TANNIN ON THE MOTILITY OF WALLEYE (STIZOSTEDION VITREUM) SPERMATOZOA, Colorado State Univ., Fort Collins. Dept. of Fishery and Wildlife Biology. D. L. Waltemyer. Transactions of the American Fisheries Society, No 4, p 808-810, 1975. 1 fig. 9 ref.

Descriptors: \*Fish eggs, \*Fertilization, Productivity, Organic compounds, Movement, \*Walleye, Water pollution effects.
Identifiers: \*Tannin, Artificial propagation, Spermatozoa, Gametes, Mobility.

Tannin has been used to decrease adhesiveness of walleye (Stizostedion vitreum) eggs during artificial propagation. Spermatozoa samples were taken from ripe male walleye to investigate the effect of tannin concentrations on spermatozoa motility or fertilizing capacity. A statistically significant relationship in reduction of spermatozoa motility with increasing tannin concentrations resulted. It was recommended that tannin be withheld until the second rinse after fertilization during artificial propagation. (Klein) W76-03773

CHLORINE-INDUCED MORTALITY IN FISH, Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology. D. R. Grothe, and J. W. Eaton. Transactions of the American Fisheries Society, No 4, p 800-802, 1975. 11 ref.

Descriptors: \*Minnows, Fish physiology, \*Toxicity, \*Chlorine, \*Mortality, \*Fishkill, Respiration, Biochemistry, Water quality, Path of pollutants, Water pollution effects.

# Field 5—WATER QUALITY MANAGEMENT AND PROTECTION Group 5C—Effects Of Pollution

Identifiers: \*Fathead minnows, \*Pimephales promelas, Bioaccumulation, Tissue analysis, Anoxia, Nemoglobin, Methemoglobin.

Chlorine and chlorine-ammonia compounds were reported to be toxic to various species of freshwater fish. This toxicity in fathead minnows (Pimephales promelas) was found to be due to the oxidation of hemoglobin to methemoglobin which resulted in death due to anoxia. (Klein) W76-03775

INFLUENCE OF UPPER AND LOWER TEM-PERATURE EXTREMES ON THE SWIMMING PERFORMANCE OF TILAPIA MOSSAMBICA, Madural Univ., (India). Dept. of Biological Sciences.

M. N. Kutty, and N. Sukumaran. Transactions of the American Fisheries Society, No 4, p 755-761, 1975. 5 fig, 2 tab, 25 ref.

Descriptors: \*Temperature, Swimming, Velocity, Oxygen, Heated water, Water quality, \*Fish behavior, Fresh water fish, Current(Water), Fish physiology, \*Thermal pollution, Water pollution effects, Tilapia. Identifiers: \*Tilapia mossambica.

Tilapia mossambica acclimated to 30C in fresh water and forced to swim at current speeds of 36, 6, and 82 cm/s in Blazka's activity apparatus failed to swim at 39.7, 38.4 and 37.0 C, respectively, when the temperature of ambient water was gradually increased from the acclimation temperature. The lower critical temperatures of swimming failure at the same swimming speeds were 17.4, 18.8 and 19.8 C, respectively. The pattern of swimming failure at the critical temperature was similar to that at critical ambient oxygen concentrations. At both upper and lower critical zones fish swam steadily again when the temperature stress was reduced. The upper avoidance temperature of T. mossambica in relatively quiet water was much lower than the upper critical temperatures of swimming failure. Since such failures did not incapacitate the fish from further performance and since the critical temperatures could be considered as points in a temperature gradient in running water, it appeared that these temperatures were indicative of a thermal avoidance in running water. (Klein)

THE EFFECTS OF TEMPERATURE ON THE DEVELOPMENT AND SURVIVAL OF THE EGGS AND LARVAE OF THE ATLANTIC SILVERSIDE, MENIDIA MENIDIA, New York Ocean Science Lab., Montauk. Dept. of

Fisheries Oceanography.
H. M. Austin, A. D. Sosnow, and C. R. Hickey, Jr.

H. M. Austin, A. D. Sosnow, and C. R. Hickey, Jr. Transactions of the American Fisheries Society, No 4, p 762-765, 1975. 1 fig, 2 tab, 8 ref.

Descriptors: \*Silversides, \*Heated water, \*Growth stages, \*Temperature, \*Fish eggs, Embryonic growth stage, Mortality, Water quality, Powerplants, Larvae, Water pollution effects, Growth rates, New York, \*Thermal pollution. Identifiers: \*Atlantic silversides, Menidia menidia, Long Island Sound(NY).

Eggs of Atlantic silverside (Menidia menidia) were fertilized and incubated at 15, 17, 20, 25 and 30C. The times to hatching at each temperature were 27.0, 12.4, 9.8, 4.8 and 3.0 days, respectively. Thermal shocks of +8C produced a 0% mortality for larvae reared at 17C, and 11% for larvae reared at 30C. Thermal shocks of +14C produced 3% mortality for larvae reared at 17C, 0% for larvae reared at 20C, and 100% for larvae reared at 25 and 30C. Since the larvae of M. menidia are present in the 15-20C range, it appears that the population would undergo a minimum of stress due to thermal shock as a result of nuclear power plant development at Long Island. (Klein)

INHIBITION OF SALT WATER SURVIVAL AND NA-K-ATPASE ELEVATION IN STEEL-HEAD TROUT (SALMO GAIRDNERI) BY MODERATE WATER TEMPERATURES, Bureau of Sport Fisheries and Wildlife, Cook, Wash, Western Fish Nutrition Lab.

Wash, Western Fish Nutrition Lab. B. L. Adams, W. S. Zaugg, and L. R. McLain. Transactions of the American Fisheries Society, No 4, p 766-769, 1975. 2 fig, 1 tab, 10 ref.

Descriptors: \*Temperature, \*Salmonids, \*Trout, \*Enzymes, Fish physiology, Heated water, Heat resistance, Life cycles, Growth rates, Growth rates, Growth stages, Water quality, Biochemistry, Inhibitors, Water pollution effects.

Identifiers: \*Steelhead trout, \*Na-K-ATPase, Tister.

sue analysis, Parr growth stage, Smolt growth stage.

The steelhead trout metamorphosis from a freshwater parr to a sea water-tolerant smolt possessing the migration tendency was evaluated at six different growth temperatures ranging from 6 to 15C during January through July. The highest temperature where a transformation was indicated was 11.3C. By April fish reared at 6C had elevated AT-Pase levels typical of smolts or migratory animals and showed 92% survival in sea water. Ten and 11.3C-reared fish showed a short lived elevation in ATPase in mid-April alone concurrently with 100% sea water survival at that time. Only in 6 C-reared animals did the salt water survival ability continue into May. High ATPase levels likewise were prolonged into May and June only inthe 6C-reared group. The data indicated that metamorphosis (and therefore successful migration) of juvenile steelhead trout was directly controlled by water temperature. (Klein)

TOTAL POPULATION DENSITY OF CRUSTACEA AND AQUATIC INSECTA AS AN INDICATOR OF FENTHION POPULATION OF RIVER WATER,

Plant Protection Research Inst., Pretoria (South Africa). For primary bibliographic entry see Field 5G. W76.03.779

RELATIVE IMPORTANCE OF FOOD AND WATER IN LONG-TERM ZINC-65 ACCUMULATION OF MARINE BIOTA, International Lab. of Marine Radioactivity, Monte

International Lab. of Marine Radioactivity, Mon Carlo (Monaco). Oceanographic Museum. W. C. Renfro, S. W. Fowler, M. Heyraud, and J.

LaRosa.
Journal of the Fisheries Research Board of Canada, Vol 32, No 8, p 1339-1345, August 1975. 2 fig. 3 tab. 8 ref.

Descriptors: Zinc, \*Radioisotopes, \*Zinc radioisotopes, Shrimp, Crabs, Fish, Analytical techniques, Path of pollutants, Metals, Water quality, \*Absorption.

Identifiers: \*Bioaccumulation, Tissue analysis,

Shrimp, crabs, and fish were maintained for 3 months in a 652n-labeled simulated ecosystem in which individuals were allowed to accumulate the radiotracer either directly from the water or from a combined food and water pathway. Shrimp and crabs, receiving 652n from the food-water milieu, did not attain significantly higher 652n body burdens than those individuals that accumulated the isotope from water only. For fish, the food pathway accounted for only 2.5 times more 652n than that obtained after direct accumulation from water. Specific activity measurements of both organisms and water as well as comparisons of radioactive concentration factors with those based on stable element measurements indicated that 652n in organisms had not reached isotopic equilibrium with the isotope in the water, even though net 652n accumulation in shrimp and crase had ceased by the end of the experiments. It was

concluded that there are zinc pools within adult organisms that exchange only slowly, if at all, with zinc atoms available in the organisms' food or surrounding water. (Klein) W76-03780

IDENTIFICATION AND POTENTIAL BIOLOGICAL EFFECTS OF THE MAJOR COMPONENTS IN THE SEAWATER EXTRACT OF A BUNKER FUEL, California Univ., Berkeley. School of Public Health.

For primary bibliographic entry see Field 5A. W76-03781

HIGH ETHYLMERCURY IN RIVER FISH BY MAN-MADE POLLUTION, Tokyo Dental Coll. (Japan). Dept. of Hygiene. For primary bibliographic entry see Field 5B. W76-03782

ACCUMULATION AND APPARENT ABSENCE
OF DDT METABOLISM BY MARINE
COPEPODS, CALANUS SPP. IN CULTURE,
Bedford Inst., Dartmouth (Nova Scotia). Marine
Ecology Lab.
D. C. Darrow, and G. C. H. Harding.

Journal of the Fisheries Research Board of Canada, Vol 30, No 10 p 1845-1849, 1975. 2 tab, 17 ref.

Descriptors: \*DDT, \*Chlorinated hydrocarbon pesticides, \*Copepods, Equilibrium, Plankton, Path of pollutants, Toxicity, Radioisotopes, Metabolism, \*Absorption.
Identifiers: \*Calanus spp., Tissue Analysis, Bioaccumulation

14C-p, p'-DDT was taken up from sea water by nonfeeding marine copepods held at 6C for 8 weeks. Calanus spp. reached an equilibrium DDT level of 50-100 ppm (dry weight) after 3-4 weeks of exposure in an initial water concentration of about 450 pptr. No metabolites of p,p'-DDT could be detected during this period. (Klein) W76-03784

HERITABLE RESISTANCE TO GAS BUBBLE DISEASE IN FALL CHINOOK SALMON, ON-CORHYNCHUS TSHAWYTSCHA, Oregon Wildlife Commission, Gold Beach. S. P. Cramer, and J. D. McIntyre. Fishery Bulletin, Vol 73, No 4, p 934-938, 1975. 3

Descriptors: "Salmonids, "Fish diseases, "Genetics, "Chinook salmon, "Resistance, Evolution, Gases, Oyxgen, Fish genetics, Columbia River, Dams, Mortality, Fish stocking, Water pollution effects.

Identifiers: Heritability, "Gas bubble disease.

Differences between fall chinook salmon Oncorhynchus tshawytscha) stocks indicated that selection for phenotypes with greatest resistances to gas bubble disease has occurred in the Columbia River, an area of active dam construction. This conclusion was supported by the observation that stocks with the longest histories of exposure to airsuper-saturated water were most resistant to gas bubble disease. The low heritability for resistance to gas bubble disease indicated that no great increases in resistance can be expected even at relatively high selection intensities. Stocks transferred from coastal streams to hatcheries within the Columbia River drainage may experience high levels of mortality from gas bubble disease. Columbia River stocks may provide a source of brood fish that are resistant to the disease for stocking in other waterways. (Klein)

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Waste Treatment Processes—Group 5D

EFFECTS OF TEMPERATURE ON OIL REFINERY WASTE TOXICITY, Utah State Univ., Logan. Dept. of Civil and En-

vironmental Engineering.

J. H. Revnolds, E. J. Middlebrooks, D. B.

Forcella, and W. J. Grenney.

Journal Water Pollution Control Federation, Vol. 47, No. 11, p. 2674-2693, 1975. 2 fig., 15 tab, 73 ref. OWRT B-070-UTAH (8).

Descriptors: Methodology, \*Oil waste, \*\*Thermal pollution, \*Chlorophyta, Mathematical models, Inhibition, Enzymes, Biochemistry, Model studies, Oil wastes, Water quality, Algae, Industrial wastes, Temperature, \*Toxicity, Phenols, Water pollution effects.

Identifiers: Selenastrum capricornutum, Oil

refinery wastes.

A continuous flow kinetic model was developed to A continuous now kinetic model was developed to describe phenol toxicity to the green alga Selenastrum capricornutum and to predict the effects of temperature on the toxicity of a specific oil refinery waste. The model was based on Michaelis-Menten enzyme inhibition kinetics, with ammonium nitrogen limited, continuous flow algal cultures grown between 20 and 28C. Phenol was the controlling inhibitor. The model was applied to continuous flow algal cultures exposed to an actual oil refinery waste. The phenol and oil refinery waste exerted competitive inhibition of Selenas-trum capricornutum. Phenol was more toxic at 24C than at either 20 or 28C. The oil refinery waste was approximately 10 times more toxic than pure phenol to Selenastrum capricornutum. (Klein) W76-03786

SESTON COMPOSITION IN THE POINT PELEE AREA OF LAKE ERIE, Lake Erie Fisheries Research Station, Wheatley

(Ontario).

J. H. Leach.

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International Revue der Gesamten Hydrobiologie, Vol 60, No 3, p 347-357, 1975. 3 fig, 6 tab, 35 ref.

Descriptors: \*Detritus, Sediments, \*Algae, \*Lake Descriptors: "Detruits, Seaments, "Agage, "Lake sediments, "Seston, Seasonal, "Regression analy-sis, "Carbon, "Decomposing Organic Matter, Great Lakes, Sediment load, Suspended solids, Zooplankton, Phytoplankton, Analytical techniques, Methodology, "Lake Erie. Identifiers: Pigments, Particulate organic carbon.

Seasonal variation in several components of or-ganic seston in two areas of Lake Erie are described. Estimates from regression analysis indescribed. Estimates from regression analysis indicate that about one-third of organic matter was living algae; the remainder was detritus. The amount of detrital carbon was least in summer and maximal in autumn. This distribution was related to sediment resuspension and rate of organic matter decomposition. Major sources of detritus were considered to be allochthonous organic matter, particularly municipal and industrial wastes, and resuspended sediments. (Katz)

PROBLEM OF MERCURIALISM IN CONNECTION WITH MERCURY POLLUTION OF THE ENVIRONMENT, (IN RUSSIAN), For primary bibliographic entry see Field 5B. W76-03796

CHANGES OF THE GROUNDWATER SUPPLY CONDITIONS IN CONNECTION WITH CONSTRUCTION OF RESERVOIRS (BASED ON EX-PERIENCE OF THE GORKI RESERVOIR, (IN

RUSSIAN), Gorkovskii Meditsinskii Institut (USSR). T. S. Yurasova. Gig Sanit. 8. 88-89. 1974.

Descriptors: \*Groundwater, \*Water supply. Public health, \*Reservoir construction, Impoundments, Water pollution effects, Rivers.

Identifiers: \*Gorki Reservoir(USSR), Russian-SFSR, USSR, Volga, River.

The hygienic effect of streamflow control on groundwater supply conditions was evaluated.
Measures for its improvement were developed. based on experience of long-term observations of the Gorki reservoir on the Volga River (Russian SFSR, USSR)--Copyright 1975, Biological Ab-

EPIDEMIOLOGY OF SALMONELLAE AND FERTILIZING OF GRASSLAND WITH WITH SEWAGE SLUDGE (SALMONELLENEPIDEMIOLOGIE UND GRUENLANDDUENGUNG KLAERSCHLAMM), E. Hess, and C. Breer.

Zentralblatt fuer Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, I. Abteilung Originale Reihe B, Vol. 161, No. 1, p 54-60, 1975. 1

Descriptors: \*Water pollution effects, Epidemiology, \*Waste water treatment, \*Sludge treatment, \*Salmonella, Disinfection, Sludge disposal, Anaerobic digestion, Fertilization, Ir-radiation, Gamma rays. Identifiers: Pasteurization.

Research conducted identified Salmonellae in more than 90% of sewage sludge samples collected. The maximum number of organisms found was 10,000,000/liter. Neither aerobic stabilization nor anaerobic digestion significantly reduced the Salmonellae contamination. Salmonellae in sewage sludge applied to grasslands can survive up to 72 weeks. Therefore, fertilizing with non-disinfected sludge may lead to transmission from plant to animal. There is an increasing number of Sal-monella carriers among herds of cattle demon-strating that transmission is occurring and is a growing danger. The disinfection of sludge to be used as fertilizer is now a necessity. The disinfecting effect of pasteurization and of gamma irradiation on sewage sludge was investigated. Proper pasteurization in 5 plants (70 C for 30 min) resulted n 98-100% of the tested sludge samples containing less than 10 Enterobacteriaceae per gram. Applica-tion of 300 krad resulted in 97.2% of the samples containing less than 10 Enterobacteriaceae per gram. (Orr-FIRL) W76-03807

STUDIES ON PREVENTION OF WATER POL LUTION. IV. EFFECT OF SYNTHETIC DETER-GENTS ON WASTE PURIFICATION WITH AC-TIVATED SLUDGE PROCESS (SUISHITSU ODAKU BOSHI NI KANSURU KENKYU (DAI PO). HAISUI NO KASSEIODEI SHORI NI OKERU GOSEI SENZAI NO EIKYO NI

Tohoku Coll. of Pharmacy, Sendai (Japan). O. Sakaguchi, Y. Yokota, and S. Takashita. Eisei Kagaku, (The Journal of Hygienic Chemistry), Vol 21, No 4, p 194-198, 1975. 5 tab, 19 ref.

Descriptors: \*Detergents, \*Sewage treatment, \*Activated sludge, \*Alkylbenzene sulfonates, Water pollution, Biodegradation, Aeration.

The effects of synthetic or commercial detergents on the efficacy of the activated sludge process was studied. Difficulties were observed in purifying sewage containing linear alkylbenzene sulfonate (LAS), which remained in the alkaline range (pH (LAS), which remained in the alkaline range (pit 8.2). While 10 ppm of LAS did not affect the purification of sewage by activated sludge, the addition of over 50 ppm LAS inhibited removal rates of both proteins and the detergent. The biodegradation of LAS was found to be inhibited by notified added in the assware, but higher fatty. by nutrients added in the sewage, but higher fatty acid sulfate showed a high degree of detergent removal from the sewage. In the case of commercial synthetic detergents, about 90% were degraded. For these, the presence of nutrients in-creased the amount of residual detergent in the supernatant after aeration. It was also seen that TTC reduction of substrates with activated sludge was slightly inhibited by the addition of LAS in the reaction medium. (See also W75-12316) (Kramer-W76-03820

SUMMARY OF HYDROLOGIC CONDITIONS AND EFFECTS OF WALT DISNEY WORLD DEVELOPMENT IN THE REEDY CREEK IM-PROVEMENT DISTRICT, 1966-73, Geological Survey, Winter Park, Fla For primary bibliographic entry see Field 4C. W76-03908

Gig Sanit. 11. 63-66. 1974.

Descriptors: \*Algae, \*Bacteria, \*Cyanophyta, Reviews, Gases, Self purification, Pseudomonas. Identifiers: \*Autochthonous bacteria, Autochthonous bacteria, Chlamydobacteriales, Chroococ-Beggiatoales, cales, Eubacteriales, Nostocales, domonadales, \*Gas vacuoles.

The literature on the significance of gas vacuoles for the biology of blue-green algae and autochthonous aquatic bacteria is reviewed. The collapse and formation of gas vacuoles lead to marked change in the specific weight of the host cells and thereby enable them to descend to the necessary depth or rise to the surface of waters. The gas vacuoles play an important role in processes of natural self-purification of waters. Further study will reveal new conditions affecting links of the cycle of matter in waters and consequently the sanitary state of the waters. Chrococcales, Nostocales, Pseudomonadales, Chlamydobacteriales, Eubacteriales and Beggiatoales are discussed.—Copyright 1975, Biological Abstracts, Inc. W76-03964

OVERSNOW RUNOFF EVENTS AFFECT STREAMFLOW AND WATER QUALITY, Forest Service (USDA), Laramie, Wyo. Forest Range and Watershed Lab. For primary bibliographic entry see Field 4D. W76-03965

SEDIMENT TRANSPORT FROM BIG SAGEBRUSH WATERSHEDS, Forest Service (USDA), Laramic, Wyo. Forest Range and Watershed Lab. For primary bibliographic entry see Field 4D. W76-03966

#### 5D. Waste Treatment Processes

RAPID SETTLER APPARATUS,

M. J. Bebech.
U. S. Patent No. 3,919,084, 6 p., 10 fig., 9 ref; Official Gazette of the United States Patent Office, Vol. 940, No. 2, p. 890-891, November 11, 1975.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution control, Settling basins, Separation techniques, Liquid wastes, Solid wastes, Sludge treatment, Equipment.

A solid settler apparatus for liquid-solid mixtures of various types comprise a number of abutted flat separator modules each including vertically spaced separator chambers. Each separator chamber has downward and inward inclined settler trays. A center solids collecting zone and a bottom

#### Group 5D-Waste Treatment Processes

solids discharge outlet is included. The flow of the liquid-solid mixture is through a conduit upward from one chamber to the adjacent vertically above chamber for series flow of the solid-liquid mixture through the settler modules. Collectors and distributors connect to the modules at the outlets. Alternate compaction means connect to the collector and distributor for receiving thickened liquid-solid mix and further separating the liquids and discharge of the compacted solids. (Sinha-OEIS) W76-03509

SEWAGE TREATMENT APPARATUS,

NUS Corp., Rockville, Md. (Assignee). D. F. Peck, and J. C. Troy U S Patent No 3,919,086, 5 p, 7 fig, 9 ref; Official Gazette of the United States Patent Office. Vol

940, No 2, p 892, November 11, 1975 Descriptors: \*Patents, \*Waste water treatment,

\*Sewage treatment, \*Organic wastes, \*Activated sludge, Aeration, Biological treatment, Flocculation, Water pollution control, Separation techniques, Septic tanks, Equipment. Identifiers: Imhoff tanks.

An Imhoff tank is converted into an activated sludge facility. The conversion is accomplished by relocating the feed from its normal position in the center settling compartment to one of the gas vent slots along the side of the Imhoff tank. Air sparges are installed along the bottom of both sides of the large bottom digestion compartment, and a simple air-lift pump is installed having its suction end at the very bottom of the inverted pyramid of the digestion chamber with its discharge into the gas vent area at the top of the tank near where the influent feed enters the device. Since the feed enters the outer compartment through the vents, its must flow upward through the slot in the bottom of the settling chamber to reach the exit. In flowing upward through this narrow slot, the aerated feed stock carries some floc with it due to its velocity However, as the settling chamber widens, the velocity slows and the suspended particles come to an equilibrium position forming a fluidized sludge bed through which the water must rise. This fluidized bed functions as a strainer and tends to filter out and agglomerate the finer particles resulting in water of exceptional clarity. (Sinha-OEIS) W76-03510

CONTINUOUS PRESSURE FILTERING AND/OR SCREENING APPARATUS FOR THE SEPARATION OF LIQUIDS AND SOLIDS.

Secondary Processing Systems, Warren, Pa. (Assignee).

I. S. Brumagin. U S Patent No 3,919,087, 5 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 940, No 2, p 892, November 11, 1975.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution control, Soli \*Filtration, Filters, \*Separation Solid wastes. techniques, Hydraulic systems, Equipment, Liquid effluent. Identifiers: Filter cake.

The solids-liquid slurry is pumped by means of apump capable of developing up to several hundred pounds of hydraulic pressure into a jacketed cylinder, the inner shell of which is a screen-filter complex designed to withstand the hydraulic pressure. A screw of a diameter to turn closely within the complex removes the solids built up and moves them toward the discharge end of the cylinder. The outside diameter of the screw versus the inside diameter of the filter complex determines the depth of filter cake permitted to accumulate on the filter complex. The liquid is forced by the hydraulic pressure through the accumulated solids and the screen and/or filter complex into the jacket from which it is piped for further processing. (Sinha-OEIS) W76-03511

SURFACE SKIMMING SYSTEM,

Ecodyne Corp., Lincolnshire, Ill. (Assignee).

Ecodyne Corp., Directorated P. R. L. Shaffer. U. S. Patent No. 3,919,090, 4 p., 2 fig., 7 ref; Official Gazette of the United States Patent Office, Vol. 940, No. 2, p. 873, November 11, 1975.

Descriptors: \*Patents, \*Waste water treatment, \*Domestic waste, Industrial wastes, Water pollu-tion control, Separation techniques, Equipment, Scum, \*Skimming.

A sewage or industrial waste treatment system has a clarified tank as one stage in the operation. As solids separate from effluent by settling, very light solids tend to float and form a scum on the surface. A surface skimmer is provided which includes a rotating skimming arm, a scum blade and pocket assembly, and a scum baffle. The skimming arm sweeps the surface of the clarifier pushing the floating matter ahead of it. The scum blade and pocket assembly is secured to the outer end of the skimming arm for receiving and directing the outwardly moving floating matter into the scum baffle. The scum baffle is located adjacent the outer periphery of the clarifier tank and in-cludes a scum beach and trough assembly to receive the floating matter collected in the scum pocket. A pair of scum blades are positioned adjacent one another in an overlapping relationship and are independently biased agains the side walls of the scum baffle by flexible support members. The flexible support members are in turn secured to the skimmer arm through a torsion bar so as to permit vertical movement of the scum blades while maintaining a downward bias as they move along the scum beach. (Sinha-OEIS) W76-03512

PROCESS AND INSTALLATION FOR THE TREATMENT OF WATER AND OTHER

Abwassertechnik und Kunst stoffbau GmbH, Waiblingen (East Germany). (Assignee). For primary bibliographic entry see Field 3A. W76-03515

ION EXCHANGE OF METALS FROM AQUE-

OUS SOLUTIONS,
Marathon Oil Co., Findlay, Ohio. (Assignee).
P. A. Argabright, L. M. Echelberger, and B. L.

U S Patent No 3,920,545, 5 p, 5 ref; Official Gazette of the United States Patent Office, Vol 940, No 3, p 1368, November 18, 1975.

Descriptors: \*Patents, \*Industrial wastes, \*Waste water treatment, Water purification, Water pollution control, \*Metals, \*Ion exchange, Mercury, Lead, Chemical reactions, Resins, Aqueous solu tions

Identifiers: Polyisocyanurate salts, Barium

Metals can be removed from aqueous solutions by contacting such solutions with a composition formed by reacting polyisocyanurate salts with synthetic resins. The resulting composition contains polyisocyanurate salt groups which act as exchange sites for removing the metals from solution. Regeneration by treatment with suitable inor ganic metal salts and use of chloromethylated synthetic resins in the forming of the polymer are utilized. The invention is useful for the removal of metals from a wide variety of aqueous solutions including industrial and commercial effluents, for purification of process streams, thereby preventing precipitation on internal screens or filters; for removal of deleterious metals from ingestible liquids, e.g., drinking water; for removal of metals where they could react with commercial products e.g., as in catalyst production or in hydrocarbon conversion processes. (Sinha-OEIS) W76-03516

METHOD OF DESTROYING CYANIDES, Houston Research, Inc., Tex. (Assignee).

R. L. Garrison, H. W. Prengle, Jr., and C. E. Mank

U S Patent No 3,920,547, 7 p, 1 fig, 1 tab, 8 ref; Official Gazette of the United States Patent Office, Vol 940, No 3, p 1369, November 18, 1975

Descriptors: \*Patents, \*Industrial wastes, \*Waste water treatment, \*Water pollution treatment, Water pollution control, Ozone, Ultraviolet radiation Iron

Identifiers: \*Cyanides, Water pollution preven-

The Method allows for the effective utilization of ozone in the destruction of cyanides, specifically, cyanides complexed with iron. This destruction of such cyanides in an aqueous cyanide solution is provided by contacting an aqueous solution of cyanides with an ozone-containing gas and simultaneous irradiating the aqueous cyanide solution with ultraviolet light. The contact of the aqueous solution of cyanides and ozone-containing gas is carried out while maintaining the pH of the aqueous solution of cyanides within the range of 5-9. In addition, the reactivity of the system can be enhanced by heating the solution to a temperature of from about 30 deg to about 70 deg C. during the contact with the ozone-containing gas. The method is carried out by contacting the aqueous cyanide solution and ozone-containing gas in a plurality of separate contact zones, countercurrently or with parallel flow, with the simultaneous irradiation with ultraviolet light being carried out in at least one of the separate contact zone, preferably, at least in the last zone of contact when the cvanide ion concentration is a minimum and the reaction rate must be enhanced. (Sinha-OFIS) W76-03517

WET OXIDATION PROCESS FOR WASTE

MATERIAL, Barber-Colman Co., Rockford, Ill. (Assignee). W. M. Fassell, and D. W. Bridges U S Patent No 3,920,548, 9 p, 5 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 940, No 3, p 1370, November 18, 1975.

Descriptors: \*Patents, \*Waste treatment, \*Sewage treatment, \*Oxidation, Waste disposal, Liquid waste, Waste water disposal, Treatment facilities. Identifiers: \*Wet oxidation.

The wet oxidation of carbonaceous waste materials with an oxidizing gas is effected in a horizontally-elongated reactor vessel divided into generally cylindrical, interconnecting, compartments. An aqueous dispersion of the wastes is continuously introduced into a compartment at one end of the reactor vessel, and flows from compartment to compartment while an oxidation gas is continuously introduced into each compartment. The dispersion is vigorously agitated to disperse the oxidizing gas, and thereby effect oxidation of the waste materials to produce an ecologically acceptable effluent. The average temperature of the dispersion is maintained at a low level, and the pH is held in the acid range. (Sinha-OEIS) W76-03518

SELF-CONTAINED WATER TREATMENT SYSTEM.

For primary bibliographic entry see Field 5F. W76-03519

DEALING WITH OIL SPILLAGE CONTAMINA-

National Water Well Association, Worthington, Ohio.

For primary bibliographic entry see Field 5G. W76-03522

INTERFACE OF ELECTROCHEMICAL AND CONVENTIONAL METHODS FOR POLLU-TION CONTROL, Pacific Engineering and Production Co. of

Pacific Engineering and Production Co. of Nevada, Henderson.

R. C. Rhees.

In: Electrochemical Contribution to Environmental Protection, Thedore R. Beck, et al., editors. The Electrochemical Society, Inc., Princeton, New Jersey, 1972, p 147-158. 7 fig, 4 plates, 1 ref.

Descriptors: \*Electrochemistry, \*Waste water treatment, \*Electrolytes, \*Equipment, Industrial wastes, Anodes, Cathodes, Gases, Sewage treatment, Effluents, Odor, Disinfection.

Identifiers: \*Electrolytic systems, Hypochlorite

The efficiency and cost benefits of the PEPCON (Pacific Engineering and Production Company Nevada) electrolytic waste treatment system for domestic and industrial wastes is described. Commercial systems are available largely for disinfection of sewage plant effluents, bacterial control in industrial waste streams, and for odor control to liquid and gaseous effluents. The basic unit of the system consists of a metal tube, which serves as the cathode and container, mounted on and sup-ported by the cathode bus. The anode is a graphite rod electroplated with a dense, hard, impervious lead dioxide coating. The anode is inserted into the metal tubing and sealed in place with non-conducting supports and spacers. The graphite rod projects above the anode-cathode assembly and is electrically connected to the anode bus. The liquid waste or brine stream is pumped through the cell; the cells are grouped into modules. Interfacing the electrochemical treatment with municipal waste treatment systems can occur at lift stations in the sewage collection network, at the headworks of the plant, on the supernatant streams from the anaerobic digestors, for disinfection of the effluent, and for overtreatment of effluent water for reuse. Various installations are described including one being developed for a shipboard treatment plant. (Auen-Wisconsin)

POROUS CATHODE CELL FOR METALS REMOVAL FROM AQUEOUS SOLUTIONS, PPG Industries, Inc., New Martimsville, W. Va. Natrium Technical Center

Natrium Technical Center. G. A. Carlson, and E. E. Estep.

In: Electrochemical Contribution to Environmental Protection, Theodore R. Beck, et al., editors. The Electrochemical Society, Inc., Princeton, New Jersey, 1972, p 159-166. 5 fig, 2 tab.

Descriptors: \*Electrochemistry, \*Waste water treatment, \*Cathodes, \*Cation adsorption, \*Metals, Anodes, Iron, Lead, Nickel, Electrolytes, Brines, Electrolysis, Ions, Copper, Pilot plants, Mercury.

Identifiers: Diaphragm cell, Caustic soda purification.

To upgrade diaphragm cell caustic soda quality, PPG Industries, Inc., of West Virginia, developed an electrolytic method to remove metallic impurities (iron, nickel, and lead) from caustic solutions. Solutions were pumped through a porous carbon or graphite cathode electrolytic cell where metal ions were reduced and deposited. Commercially the cell has improved product quality and lowered costs. The cell removes low metal concentrations from aqueous solutions to improve quality, clean effluent streams, or recover metal. When the cell was used commercially for diaphragm cell caustic soda purification, iron, lead, calcium oxide, and magnesium oxide were reduced; the product remained permanently clear. With the downstream, lead and copper were deposited first, nickel throughout, and iron nearest the anode. With the anode upstream, iron was first followed by copper, lead, and nickel. During pilot plant removal of mercury from brine and waste streams, an impervious graphite anode was used. Feed solution should be acidified, dechlorinated, and filtered. Downstream anodes minimized chlorinacontact with mercury in the cathode and permitted better mercury removal. The cathode can be regenerated. Other metal and electrolyte systems should be amenable to processing in this cell, depending on metal ion nature and concentration, solution colume, and costs. (Buchanan-Davidson-Wisconsin)

THE BASIC ELECTRIC CELL IN EFFLUENT TREATMENT,

Swift and Co., Oak Brook, Ill. Research and Development Center.

E. C. Beck, and A. P. Giannini

In: Electrochemical Contribution to Environmental Protection, Theodore R. Beck, et al., editors. The Electrochemical Society, Inc., Princeton, New Jersey, 1972, p 167-170.

Descriptors: \*Waste water treatment, \*Electric currents, \*Emulsions, \*Industries, Hydrogen ion concentration, Dissolved oxygen, Biochemical oxygen demand, Flotation, Suspended solids, Corrosion.

Identifiers: \*Impressed current systems, Electric cells.

Effectiveness of standard equipment in effluent treatment can be increased on plant effluent streams by creating a three dimensional anolyte stream in the equipment. Field studies of impressed current effects on waste treatment show that anode pH may be 4 units lower than influent pH. At the cathode, pH increases. Most emulsions are broken by mineral acids or the anionic action of the impressed current system. Depending on current density, dissolved oxygen can increase 300% the value obtained by passing air through the solution. Impressed current can dissipate biochemical oxygen demand, assist in suspended particle flotation, convert sulfide to thiosulfate, help remove suspended particles, and protect equipment from corrosion. On passing through an electric field, effluents seem more susceptible to chemical treatment and test results are enhanced. With efficient equipment, ponds and long treat-ments are eliminated. Electric cell action is rapid thus large volumes of waste can be handled. In a field test with a single treatment and skim tank coupled with moderate chemical treatment, 90% of the biochemical oxygen demand, 98% of the grease, and 92% of the suspended solids were removed. The operation is successful in edible oil refineries, packing plants, and rendering facilities. (Buchanan-Davidson--Wisconsin) W76-03534

WASTEWATER USE IN THE PRODUCTION OF FOOD AND FIBER--PROCEEDINGS.

Robert S. Kerr Water Research Center, Ada, Okla.

Environmental Protection Agency, Report EPA-660/2-74-041, June 1974, 568 p.

Descriptors: \*Aquaculture, \*Irrigation practices, \*Waste water treatment, \*Crop production, \*Conferences, Research facilities, Thermal water, Daphnia, Catfishes, Forage grasses, Fiber crops, Trees, Salmon, Public health, Water law, Water hyacinth.

Identifiers: \*Fish culture, \*Aquatic plant culture.

An interdisciplinary group of about 200 persons met to review the present base of scientific knowledge relating to benefits and constraints of using wastewaters for production of food and fiber. There were 27 papers presented by representatives from the fields of public health, engineering, agriculture, aquaculture, and other related scientific disciplines. Papers in two sections on potential restraints cover topics such as historical instances of disease transmission, possible transport of microbial pathogens through the food chain, legal implications, and sociological reac-

tions. The aquaculture section deals primarily with experiment studies including such diverse approaches as culture of adaphnia, salmon smolts, and water hyacinth. The agriculture section emphasizes the use of wastewater for crop production and the papers presented include case histories for long-term operating systems, as well as data from experimental studies. In addition to those papers presented at the conference, nine others have been included to make a total of 36 papers in the conference proceedings. (See W76-03542 thru W76-03576) (Thomas-EPA)

REVIEW OF AMERICAN PUBLIC WORKS AS-SOCIATION STUDY OF FACILITIES UTILIZ-ING LAND APPLICATION OF WASTEWATER, American Public Works Association, Chicago, Ill. R. H. Sullivan.

In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 2-8. 1 ref, 4 tab.

Descriptors: \*Waste water disposal, \*Irrigation water, Publications, Reviews, Waste water treatment, Water pollution control, Water pollution treatment, Surveys, Treatment facilities, Legislation, Crops, Forests, On-site investigation, Foreign countries, Waste disposal, Soil disposal fields, Regulation, Irrigation, Irrigation effects.

This article reviews some of the findings of an American Public Works Association study of effluent treatment facilities in the U.S.A. practicing land disposal of waste waters. The data were ob tained by on-site visits to approximately 100 plants and questionnaires to many more not visited. The nature and extent of state health and water pollution control regulations governing the use and control of land application systems are covered, and experience with land disposal of waste waters in foreign countries are cited. Although facilities of all types (industrial and municipal) were surveyed. the report is primarily concerned with irrigationtype facilities for supplying supplemental water to crop and forest areas and unharvested soil cover acreages. The report, titled Survey of Facilities Using Land Application of Wastewater, is available from the Government Printing Office (Washington, D.C.) as EPA-430/9-73-006 at a price of \$6.80. (See also W76-03541) (Witt-IPC) W76-03542

WASTEWATER UTILIZATION IN INTEGRATED AQUACULTURE AND AGRICULTURE SYSTEMS,

Agricultural Research Organization, Dor (Israel). Fish and Aquaculture Station.

B. Hepher, and G. L. Schroeder.

In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 9-15. 1 fig, 7 ref.

Descriptors: \*Waste water(Pollution), \*Water reuse, \*Irrigation water, \*Aquiculture, Agriculture, Water pollution sources, Water pollution treatment, Dissolved oxygen, Toxins, Irrigation, Fish farming, Irrigation.

Limitations restricting the reuse of waste water for irrigation purposes are outlined, and it is suggested that the solution to overcoming these problems lies in a system which integrates waste treatment with aquaculture and agriculture. The result is a flow of waste from the treatment plant through fish ponds to irrigated fields. The benefits of fish ponds in waste water treatment and the improvement in waste water by ponds are discussed. Problems associated with this method of treatment (such as maintaining and adequate dissolved oxygen concentration and the effects of toxic substances) are also discussed. (See also W76-03541) (Witt-IPC) W76-03543

#### **Group 5D—Waste Treatment Processes**

DISEASES TRANSMITTED BY FOODS CON-TAMINATED BY WASTE WATER, Center for Disease Control, Atlanta, Ga. For primary bibliographic entry see Field 5C. W76-03544

THE EVALUATION OF MICROBIAL PATHOGENS IN SEWAGE AND SEWAGE MICROBIAL GROWN FISH

Oklahoma State Dept. of Health, Oklahoma City. For primary bibliographic entry see Field 5C W76-03545

MORBIDITY RISK FACTORS FROM SPRAY IRRIGATION WITH TREATED WATERS.

Texas Univ., Houston. School of Public Health. For primary bibliographic entry see Field 5C.

PERMISSIBLE LEVELS OF HEAVY METALS IN SECONDARY EFFLUENT FOR USE IN A COMBINED SEWAGE TREATMENT-MARINE AQUACULTURE SYSTEM. I. MONITORING DURING PILOT OPERATION,

Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 5C. W76-03547

PERMISSIBLE LEVELS OF HEAVY METALS IN SECONDARY EFFLUENT FOR USE IN A COMBINED SEWAGE TREATMENT-MARINE AQUACULTURE SYSTEM, IL DEVELOPMENT GUIDELINES BY METHOD OF ADDI-

TIONS, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 5C W76-03548

CALCULATED YIELD OF SEWAGE LAGOON CALCULATED TIELD OF SEWAGE LAGOON BIOMASS, A PLAN FOR PRODUCTION, AND SOME OF THE PROBLEMS INHERENT IN USING BIOMASS OR LAGOON WATER FOR PRODUCTION OF FOOD AND FIBER,

Bowling Green State Univ., Ohio. Dept. of Biolo-

K. Schurr, and J. M. Golombek.

Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 102-109. 18 ref.

\*Biomass \*Sewage lagoons, Descriptors: \*Productivity, Algae, Sewage treatment, Lagoons, Waste water treatment, Harvesting, Harvesting of algae, Feeds, Soil amendments, Water pollution treatment, Water pollution control, Ohio, Aerated lagoons, Toxicity, Pathogenic bacteria, Byproducts. Identifiers: Methanol(Methyl alcohol).

Lagoon sewage treatment produces, in addition to the water, a huge volume of plant and animal the water, a luge votation of pain and aerobic lagoon at the Deshler, Ohio, waste water treatment plant yields 1596 cu m of dry biomass per hectare. Removal of the floating material could increase the yield to over 2000 cu m per hectare. Proposed methods of harvesting the biomass are given and uses are suggested, including as a com-ponent in domestic animal feeds, to generate methanol, and as a soil conditioner. Problems asas contamination by toxic substances or pathogenic bacteria, are discussed. (See also W76-03541) (Witt-IPC) W76-03549

ANALYSIS OF SEWAGE LAGOON BIOMASS SOLUBLE VITAMINS WATER MICROBIOLOGICAL TECHNIQUES, Findlay Coll., Ohio. Div. of Natural Sciences For primary bibliographic entry see Field 5A.

FEED AND FIBER FROM EFFLUENT-GROWN WATER HYACINTH.

Florida Univ., Gainesville. Dept. of Agricultural Engineering. L. O. Bagnall, T. deS. Furman, J. F. Hentges, Jr.,

W. J. Nolan, and R. L. Shirley.

In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 116-141. 7 fig, 26 ref, 7 tab.

Descriptors: \*Water hyacinth, \*Feeds, \*Fiber crops, \*\*Sewage effluents, Nutrients, Phosphorus compounds, Nitrogen compounds, Sheep, Cattle, Ruminants, Livestock, Bermudagrass, Water pollution control, Water pollution treatment, Water pollution sources, Waste water treatment, Sewage, Pulp and paper industry, Byproducts, Sewage treatment, Effluents. Identifiers: Eichhornia crassipes, Paper, Com-

post, Papermaking fibers.

Water hyacinth (Eichhornia crassipes) was used to remove nutrients, primarily nitrogen and phosphorus, from secondary treated sewage ef-fluent; some of the plants were subsequently ensiled or dried and fed to sheep and cattle and some were pulped to make paper. The irregularly harvested pond removed 10% of the nitrogen and phosphorus from the effluent, only 10% of which could be accounted for in the plant tissues. Cattle and sheep readily ate processed water hyacinth in complete diest and remained in good health, but did not utilize the nutrients as well as nutrients in a land forage, coastal Bermuda grass. The primary feeding value is as sources of energy, mineral ele-ments and roughage for ruminants. Paper can be made from water hyacinth but yield and pulp freeness are low, making production uneconomical. The paper has good breaking and bursting strength but low tearing strength. Compost may be the best use, having the highest value and lowest processing cost. (See also W76-03541) (Witt-IPC) W76-03551

THE AVAILABILITY OF DAPHNIA FOR WATER QYALITY IMPROVEMENT AND AS AN ANIMAL FOOD SOURCE,

Texas State Dept. of Health, Austin. Div. of Wastewater Technology and Surveillance. R. Dinges.

In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 142-161. 8 fig, 18 ref.

Descriptors: \*Daphnia, \*Waste water treatment, \*Biological treatment, Waste treatment, Water pollution control, Water pollution treatment, Crustaceans, Aquatic animals, Algae, Bacteria, Protozoa, Oxidation lagoons, Hydrogen ion con-centration, Photoperiodism, Light, Water tem-perature, Depth, Sulfides, Mixing, Marketing, Fish food organisms, Proteins. Byproducts.

The incorporation of advanced biological methods into waste water treatment systems to make use of fertile effluents forcyultivation of beneficial organisms appears feasible. The use of Daphnia to attain improvement of waste water is discussed.

Daphnia are common aquatic crustaceans about 1.8-inch long which feed upon algae, bacteria, Protozoa, and debris. Environmental factors affecting the growth of Daphnia in stabilization ponds are discussed, including light (photoperiod) and water temperature, depth, pH, and mineral content. Daphnia culture in waste waters requires pH control within a range of 7.0-7.5 and sufficient mixing for suppression of soluble sulfides. Equipment exists for harvesting Daphina. The present market for Daphnia is limited to fish food, but an excellent use would be as a protein additive in animal feeds. The clarified effluent is suitable for biological treatment or chemical-physical methods for further nutrient removal. (See also W76-03541) (Witt-IPC)

REPORT ON PILOT AQUACULTURE SYSTEM USING DOMESTIC WASTEWATERS REARING PACIFIC SALMON SMOLTS, Humboldt State Univ., Arcata, Calif. School of Natural Resources. For primary bibliographic entry see Field 5C. W76-03553

AQUACULTURE AS A MEANS TO ACHIEVE EFFLUENT STANDARDS.

Oklahoma State Dept. of Health, Oklahoma City. Water Quality Monitoring and Research Div. M. S. Coleman, J. P. Henderson, H. G. Chichester, and R. L. Carpenter.

In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 199-214. 5 fig, 15 ref, 2 tab.

Descriptors: \*Sewage lagoons, \*Sewage effluents, \*Fish stocking, \*Aquiculture, Water pollution sources, Water pollution treatment, Water pollution control, Oklahoma, Domestic wastes, tion control, Oklanoma, Domestic Wastes, Aerated lagoons, Ammonia, Nitrogen, Phosphorus, Costs, Income, Waste water treat-ment, Lagoons, Aquatic animals, Water pollution effects, Water quality, Stocking, \*Water quality standards, Standards, Effluents. Identifiers: Quail Creek Sewage Lagoon(Okla).

Preliminary studies by the Oklahoma State Department of Health showed that the quality of effluents from a waste water lagoon can be improved by stocking the lagoon with fish. The study was carried out at the Quail Creek Sewage Lagoon system (located near Oklahoma City, Oklahoma) system (located near Oklahoma City, Oklahoma) receiving approximately 750,000 gal/day of raw domestic sewage. The lagoon consists of 2 aerated and 4 nonaerated cells, operated serially. Amonia was reduced below 1.0 mg/liter N in effluent from the first cell. Of the total N remaining in the system, the majority from the third through sixth cells was organic nitrogen. Phosphorus showed good reduction throughout the system to a low of 2.39 mg/liter in the final effluent. Estimated costs and income from an advanced biological treatment system are given. (See also W76-03541) (Witt-IPC) W76-03554

AN EXPERIMENT IN THE EUTROPHICATION OF TERRESTRIAL ECOSYSTEMS WITH SEWAGE: EVIDENCE OF NITRIFICATION IN A LATE SUCCESSIONAL FOREST, Brookhaven National Lab., Upton, N.Y. For primary bibliographic entry see Field 5C. W76-03555

IRRIGATION WITH WASTEWATER BAKERSFIELD, CALIFORNIA, Metcalf and Eddy, Inc., Palo Alto, Calif. For primary bibliographic entry see Field 3C. W76-03556

NUTRITIVE VALUE OF AEROBICALLY TREATED LIVESTOCK AND MUNICIPAL

WASTES, Illinois Univ. at Urbana-Champaign. Coll. of Agriculture; and Illinois Univ. at Urbana-Champaign. Coll. of Engineering. D. L. Day, and B. G. Harmon

In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 240-252. 3 fig, 27 ref, 11 tab.

Descriptors: \*Municipal wastes, \*Farm wastes, \*Nutrients, \*Feeds, \*Aerobic treatment, Water pollution sources, Waste treatment, Proteins, Economics, Oxidation, Illinois, Amino acids, Costs, Water pollution treatment, Sewage treat-ment, Byproducts, Potable water. Identifiers: Lysine.

This report reviews some major studies analyzing the amino acid content of aerobically treated

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

#### Waste Treatment Processes—Group 5D

sewage and livestock wastes and evaluating the product as a protein supplement in the diets of livestock. A method developed at the University of Illinois utilizes oxidation-ditch mixed liquor (ODML) in situ, supplying drinking water as well as protein and other nutrients. Crude protein in the ODML varies from 30 to 46%, the latter value is as high as in soybean meal. Also, lysine and other amino acids essential to growth can be as high in concentrated ODML as in soybean meal. This method avoids the ordinary expenses generally associated with recycling and minimizes pollution. The present costs of soybean meal make the method economically feasible and energetically attractive. However, a more efficient method of oxidation is needed. Even so, the aerobic process offers possibilities for an inexpensive method of waste management. (See also W76-03541) (Witt-IPC)

GRASS FILTRATION FOR FINAL TREAT-MENT OF WASTEWATER,

Pennsylvania State Univ., University Park.
R. M. Butler, J. V. ilusted, and J. N. Walter.
In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 256-272. 1 fig, 9 ref, 9 tab.

Descriptors: \*Grassland, \*Waste water treatment, \*Filtration, \*Soil filters, Nitrates, Phosphates, Inorganic compounds, Phosphorus compounds, Nitrogen compounds, Sewage effluents, On-site investigations, Water pollution sources, Water pollution treatment, Waste treatment, Laboratory tests, Recycling, Waste treatment, Vegetation, Runoff.

In grass filtration systems, waste water is applied along the top of a sloping site and flows through the soil-plant filter with subsequent runoff. The removal of nitrate and phosphate from secondary treated municipal sewage effluent by a grass filtra-tion system was studied. The results of field studies indicated that the removal of both phosphate and nitrate increased as the application frequency was decreased from 6 times to 2 times/week. The duration of application can be increased as the frequency is reduced so that approximately the same depth of effluent can be applied to each plot. Comparison of samples taken during each application period indicated only slight differences in both nitrate and phosphate renovation during a run, suggesting that the grass filtration system should be operated with runs of long duration separated by several days rest. Leaving grass clippings on the plot surface increased phosphate concentrations in the waste water. In laboratory tests, 5-6 hr were required to achieve a 90% reduction in nitrate concentration from effluent with an initial concentration of 12 mg/liter nitrate-nitrogen. Under field conditions, detention times of 1.5 to 2 times the laboratory values were necessary for a similar reduction in nitrate concentration. Deten-tion times of this length can be obtained by restricting the flow rate over the plot with barriers or by recycling the effluent. (See also W76-03541) (Witt-IPC) W76-03558

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USE OF CATTLE FEEDLOT RUNOFF IN CROP PRODUCTION,

Kansas State Univ., Manhattan. For primary bibliographic entry see Field 3C. W76-03559

IRRIGATION OF TREES AND CROPS WITH SEWAGE STABILIZATION POND EFFLUENT IN SOUTHERN MICHIGAN, Williams and Works, Grand Rapids, Mich.

For primary bibliographic entry see Field 5C. W76-03560

LEGAL CONSTRAINTS ON THE USE OF WASTEWATER FOR FOOD AND FIBER, Virginia Polytechnic Inst. and State Univ., Blackburg. Water Resources Research Center. For primary bibliographic entry see Field 6E. W76-03562

SOCIAL, POLITICAL, REGULATORY AND MARKETING PROBLEMS OF MARINE WASTE-FOOD RECYCLING SYSTEMS. Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 6B. W76-03563

RECYCLING FOR A PURPOSE -- BUT FOR WHAT PURPOSE. A SOCIOLOGIST'S VIEW, Central State Univ., Edmond, Okla. Dept. of Sociology.

For primary bibliographic entry see Field 6B. W76-03564

THE MICHIGAN STATE UNIVERSITY WATER QUALITY MANAGEMENT PROGRAM, Michigan State Univ., East Lansing. Inst. of Water Research.

T. G. Bahr, R. C. Ball, and H. A. Tanner.
In: Wastewater Use in the Production of Food and
Fiber – Proceedings, March 5-7, 1974, Oklahoma
City, Oklahoma, p 362-376. 2 fig, 3 ref, 1 tab.
OWRT A-031-MICH(4).

Descriptors: \*Waste water treatment, \*Recirculated water, \*Treatment facilities, \*Research facilities, Research equipment, Design, Irrigation, Forests, Coniferous forests, Pine trees, Lakus, Nitrogen componds, Phosphorus compounds, Nutrients, Cultivated lands, Groundwater, Water quality, Water level fluctuations, Activated sludge, Michigan, Water purification, Water publiton treatment, Water pollution control, Aquiculture, Research and development, Soil disposal fields

A description is given of the development and design of Michigan State University's waste water recycling program and facility for studying the application of waste water to agriculture lands or to aquaculture systems to produce food and fiber and at the same time achieve a high degree of water renovation. The physical facility consists of a conventional activated sludge sewage treatment plant, a 4.5 mile long transmission line, a lake system (186 total acres including 40 acres of lakes), and a land irrigation system. The land irrigation system includes a pine plantation, cultivated fields, and fields that have been allowed to regress into old-field plant associations. Sixty wells surrounding both the lake and land sites will be used to monitor the level and quality of subsurface water. The physical facility affords maximum flexibility in the development of research involving an integrated land and lake system for the restoration of water quality and the recycling of nutrients (nitrogen and phosphorus). The types of studies that will be carried out with the facility and the monitoring of the chemical, physical, and microbiological parameters connected with both the operation of the waste water treatment plant and with the lake and land facets of the recycling system are described. (See also W76-03541) (Witt-IPC) W76-03565

EXPERIENCES WITH A MARINE AQUACUL-TURE-TERTIARY SEWAGE TREATMENT COMPLEX,

COMPLEX,
Woods Hole Oceanographic Institution. Mass.
J. E. Huguenin, and J. H. Ryther.

In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 377-386. 2 fig, 14 ref.

Descriptors: \*Research facilities, \*Sewage treatment, \*Aquiculture, \*Tertiary treatment, Massachusetts, Mollusks, Oysters, Clams, Mussels,

\*Waste water treatment, Wastes, Operations research, Food chains, Facilities, Pilot plants, Experimental models, Water pollution control, Water pollution treatment, Phytoplankton, Marine animals. Identifiers: Woods Hole Oceanographic Institu-

tion(Mass), Scallops.

The design features of the combined aquaculture-tertiary sewage treatment system at the Wood-Hole Oceanographic Institution, Woods Hole, Massachusetts, is described briefly, and experiences in the operation of the experimental system are described. The essence of the concept is a treated sewage-marine phytoplankton-bivalve mollusk (oysters, clams, mussels, scallops) food chain. Problems associated with the design of the plant and operation are also described. The facility produces adequate quantities of waste-grown seafoods for testing and possibly even for preliminary market testing. (See also W76-03541) (Witt-W76-03566

POLYCULTURAL WASTEWATER RECLAMA-TION AT CALIFORNIA POLYTECHNIC STATE UNIVERSITY-AN ACADEMIC INSTRUC-TIONAL SYSTEM,

California Polytechnic State Univ., San Luis Obispo. Dept. of Biological Sciences. R. J. Kreisa.

In: Wastewater Use in the Production of Food and Fiber--Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 387-4034 fig, 10 ref, 3 tab.

Descriptors: \*Research facilities, \*Water reuse, \*Waste water(Pollution), California, Biological treatment, Waste treatment, Lagoons, Aquiculture, Irrigation, Training, Education, Water pollution treatment, Water pollution control, Fish farming, Fish hatcheries, Water quality, Soil properties, Pathology, Fish diseases, Crops, Laboratories, Reclaimed water.

A description is given of the proposed waste water reclamation system designed by students of California Polytechnic State University, San Luis Obispo, California, under the direction of instructional staff and faculty. Construction of a biological treatment lagoon and experimental ponds for growing fish have been completed. Future plans call for the construction of an aquaculture unit consisting of an experimental hatchery and dry laboratories, raceway system, and a series of small ponds. The total facility will be used to investigate alternative biological and agricultural strategies of secondary treated waste water reclamation and reutilization, to monitor changes in water and soil quality attendant with the processing of waste water through the polyculture system, student training, and pulic education. The facility will utilize secondary effluent from the California Men's Colony waste water treatment plant to grow harvestable crops hydroponically, aquaculturally. The aquaculture unit wet laboratories will facilitate the study of reproductive behavior, hatching, and rearing of warm or cold water fishes. The dry laboratory portions will be equipped to study pathology of fishes and other organisms growing in the secondary effluent. (See also W76-03541) (Witt-IPC)

COLIFORM AND PHYTOPLANKTON STUDIES IN A BRACKISH WATER AQUACULTURE POND FERTILIZED WITH DOMESTIC WASTEWATER, Washington Univ., Seattle.

For primary bibliographic entry see Field 5A. W76-03568

MINERAL QUALITY OF FISH POND EF-FLUENT RELATED TO SOIL PROPERTIES AD CROP PRODUCTION, Arkansas Univ., Fayetteville.

For primary bibliographic entry see Field 3C.

#### **Group 5D—Waste Treatment Processes**

W76-03569

THE DIALECTICS OF A PROPOSAL ON BIOLOGICAL CONTROL OF EUTROPHICATION IN SEWAGE LAGOONS, National Taiwan Univ. Tainei For primary bibliographic entry see Field 5C.

THE HARVESTING OF ALGAE AS A FOOD SOURCE FROM WASTEWATER USING NATURAL AND INDUCED FLOCCULATION RAL AND TECHNIQUES.

J. L. Pavoni, S. W. Keiber, and G. T. Boblitt.

J. L. Pavoni, S. W. Keiber, and G. T. Boblitt.

In: Wastewater Use in the Production of Food and
Fiber--Proceedings, March 5-7, 1974, Oklahoma
City, Oklahoma, p 435-496, 34 fig, 45 ref, 1 tab.

Descriptors: \*Algae, \*Flocculation, \*Waste water treatment, \*Harvesting of algae, Microorganisms, Nutrients, Separation techniques, Waste treatment, Water purification, Water pollution treatment, Water pollution control, Reviews, Publications, Chemical precipitation, Polymers, Polyelectrolytes, Anions, Cations, Hydrogen ion concentration, Organic compounds, Neutralization, Research and development, Harvesting.

One of the serious drawbacks in any nutrient removal system involving algae is the separation of these microorganisms from the corresponding liquid phase. Numerous techniques have been instigated for their usefulness in algae harvesting. While the majority of methods are costly, properly managed flocculation techniques may offer a feasible, as well as economical, solution to algal-liquid separation. The literature dealing with bioflocculation and chemical flocculation of algae is reviewed, and the results of experimental stu-dies on the feasibility of harvesting algae from waste water systems by natural or induced flocculation techniques are presented. The mechanism of algal bioflocculation is interpreted as resulting from the interaction of high molecular weight ex ocellular polymers, which accumulate at the microbial surface during endogenous growth. These polymers electrostatically or physically bond, and subsequently bridge, the cells of the dispersion into a three-dimensional matrix of sufficient magnitude to subside under quiescent condi-tions. The optimum pH for algal agglutination with synthetic organic polyelectrolytes is 2-4. Optimum dosages of all synthetic polymers at optimum pH levels were in the range of 0.5-5.0 mg/liter. At neutral pH the cationic polyelectrolytes effectively flocculated the algal suspension through a combination of polymer bridging and charge neutralization, whereas anionic and nonionic polyelectrolytes failed to flocculate the algae effficiently. The addition of trivalent metal ions enhanced algal flocculation. (See also W76-03541) W76-03571

CRITICAL VARIABLES IN FOOD-ITEM POPU-LATION DYNAMICS IN A WASTE-WATER AQUACULTURE SYSTEM,

Virginia Polytechnic Inst. and State Univ., Blacksburg.

For primary bibliographic entry see Field 3C. W76-03572

THE FEASIBILITY OF PENAEID SHRIMP CUL-TURE IN BRACKISH PONDS RECEIVING TREATED SEWAGE EFFLUENT,

North Carolina State Univ., Raleigh For primary bibliographic entry see Field 5C. W76-03573

STANDING CROPS OF BENTHIC FAUNA IN MARINE AQUACULTURE PONDS USING RECLAIMED WATER, Humboldt State Univ., Arcata, Calif.

For primary bibliographic entry see Field 5C. W76-03574

CONTROLLED EUTROPHICATION: SEWAGE TREATMENT AND FOOD PRODUCTION,
Texas Univ. Medical Branch at Galveston.
J. G. Songer, N. M. Trieff, R. F. Smith, and D.

Grajcer.
In: Wastewater Use in the Production of Food and Fiber--Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 529-545. 8 fig, 10 ref, 1 tab.

Descriptors: \*Eutrophication, \*Sewage treatment, \*Marine algae, \*Brine shrimp, Shrimp, Waste water treatment, Sewage, Water pollution \*Marine algae, \*Brine shrimp, Shrimp, Waste water treatment, Sewage, Water pollution sources, Water pollution treatment, Biochemical oxygen demand, Water quality, Phosphorus, Nitrogen compounds, Coliforns, Bacteria, Salmonella, Shigella, Sewage bacteria, Aquatic animals, Foods, Commercial shellfish, Aquiculture, Water pollution control, Waste treatment, Food chains, Nutrients.

Identifiers: Tetraselmis chui. Artemia salina.

A continuous-flow laboratory-scale system has been developed for studying the eutrophication of raw sewage by the marine alga Tetraselmis chui. The subsequent algal proliferation is fed to brine shrimp (Artemia salina). Various water quality parameters are studied, and the passage of certain bacterial groups through the system is examined. Effluent BOD values, though much improved over raw sewage, are somewhat above the standard required of secondary treatment plants (i.e., 20 mg/liter). Total solids (residue on evaporation) was higher in the effluent than in the raw sewage, at-tributable in part to the presence of algal cells and also to some slight evaporation. Phosphorus was higher in the effluent than in the algal culture because of loss of phosphorus from bottom sedibecause of loss of phosphorus from bottom sediments in the brine shrimp tank. Nitrogenous wastes of the brine shrimp are probably the cause of higher nitrogen values in the effluent than in the algal culture. Fecal coliforms disappeared on passage of the raw sewage through the system. No serotypes of Salmonellae or Shigellae were detected at any stage. (See also W76-03541) (Witt-IPC) IPC) W76-03575

PRINCIPLES OF SEWAGE TREATMENT THROUGH UTILIZATION IN FISH PONDS,

National Agricultural Quality Control Inst., Budapest (Hungary). E. Donaszy.

In: Wastewater Use in the Production of Food and Fiber--Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 546-556. 6 ref.

Descriptors: \*Sewage treatment, \*Fish farming, Water pollution sources, Water pollution treatment, Sewage, Wastes, Waste treatment, Fishe-Publications, Reviews, Operations, Fish, Aquiculture, Fertilization, Planning.

The literature dealing with the use of sewage as food in fish ponds and some results of previous studies in this area are reviewed. The physical aspects and operation of a commercial fishery are described, and the biological potential of fisheries supplied with sewage is discussed. There are great advantages in integrating sewage treatment with commercial fisheries with respect to fish produc-tion and waste utilization. A brief description is given of a fishery established for the purpose of sewage treatment, and the planning of a commercial fishery for the introduction of sewage is con-sidered. Needed research in this field is outlined. (See also W76-03541) (Witt-IPC) W76-03576

REUSE OF WATER IN THE PULP AND PAPER Australian Paper Manufacturers Ltd., Melbourne

For primary bibliographic entry see Field 3E.

W76-03578

A SEMIAUTOMATED PROCEDURE FOR THE DETERMINATION OF PHOSPHORUS IN WATER, WASTE WATERS AND PARTICU-

New York State Dept. of Health, Albany For primary bibliographic entry see Field 5A. W76-03579

(PAPETERIES DE FRANCE) AUSSEDAT-REY: INAUGURATION OF THE NEW EFFLUENT PURIFICATION STATION AT SAILLAT FRANCE) (INAUGURATION A SAILLAT DE LA NOUVELLE STATION D'EPURATION DES

D. Ladmiral. La Papeterie, Vol 97, No 7/8, p 449-455, July/August, 1975. 1 fig. 5 illus.

Descriptors: \*Waste water treatment, \*Treatment Descriptors. Waste water treatment, Treatment facilities, \*Pulp wastes, Europe, Foreign countries, Water purification, Aerated lagoons, Sludge disposal, Incineration, Sludge, Biochemical oxygen demand, Suspended solids, Wastes, Industrial wastes, Water pollution treatment, Water pollution control, Pulp and paper industry. Identifiers: \*France, paper machine

Following a brief review of the facilities of the pulp and paper mill at Saillat, including the Duoformer paper machine, the effluent treatment system is outlined. The system handles the 4000 cu m effluent/hr coming from the mill and consists essentially of a homogenizing basin, a primary clari-fier, a canal-type aeration lagoon, and sludge-incinerating equipment. Effluent discharged from the aeration lagoon has a BOD of about 9 kg/ton and maximum suspended solids of 20 kg/ton. (Speckhard-IPC) W76-03580

WASTEWATER REPORT ON CHARGES, METROPOLITAN SEWERAGE DIS-BUNCOMBE COUNTY, CAROLINA.

Greeley and Hansen, Chicago, Ill. For primary bibliographic entry see Field 5G. W76-03628

ORGANIC COMPOUNDS IN PULP MILL LAGOON DISCHARGE,

Washington Univ., Seattle. Coll. of Forest Resources. For primary bibliographic entry see Field 5A. W76-03631

WASTE CONTROL AND ABATEMENT IN THE PROCESSING OF SWEET POTATOES,

North Carolina State Univ., Raleigh. Dept. of Civil Engineering.

C. Smallwood, Jr., R. S. Whitaker, and N. V. Colston

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-238 469, available in microfiche only, :2.25. Environmental Protection Agency, Report EPA-660/2-73-021, December 1974. 50 p, 4 fig. 9 tab, 39 ref. 03JIP00835

Descriptors: \*Sweet potatoes, \*Waste water treatment, Costs, Industrial wastes, \*Chemical wastes, Recycling, \*Water reuse.

The conventional processing of sweet potatoes produces a very strong caustic waste that is high in organic matter. Present technology does not emphasize recirculation or other control of water use. Improved technology is available such as high pressure low-volume water sprays and a dry caustic peeling process that reduce water use and convert the liquid caustic waste to a semi-solid waste that can be disposed of in sanitary landfills

or sold as cattle feed. Developing technology ofstream peel or an infrared dry caustic peel that in-creases yield. In-plant control of waste through process modification and/or treatment is economical and may even provide a net return on invest-ment. Biological treatment is effective. This report was prepared to make available the data collected under the first phase of the study. The majority of the analytical data characterizing sweet potato processing wastes were obtained from an in-depth study of one conventional sweet potato processing plant during the 1971 processing season. (EPA) W76-03636

EXPERIENCE IN THE SANITARY PROTEC-TION OF WATER BODIES IN A RAION OF MOSCOW, (IN RUSSIAN), Sanitary Epidemiology Station, Konakovo

(USSR).

O. M. Grinblat, V. F. Sundatov, T. I. Gusarova, and G. G. Verenova. Gig Sanit, 8, 87-88, 1974.

Descriptors: Water pollution control, Waste water treatment, \*Treatment facilities, \*Water pollution sources, Design operations, \*Water quality con-

trol, Public health.
Identifiers: \*Moscow River(USSR), Raion, Russian-SFSR, USSR.

Increased attention of the sanitary-epidemiological station of the Krasnopresnensk raion of Moscow (Russian SFSR, USSR) to protection of surface waters resulted in a determination of all wastewater discharge sources, the improvement of treatment plant design and operation and, consequently, an improvement in the water quality of the Moscow River and its tributaries in the region.--Copyright 1975, Biological Abstracts, Inc. W76-03637

POTAMOLOGICAL. EFFECTS OF FISH HATCHERY DISCHARGE,

Saint Mary's Coll., Winona, Minn. For primary bibliographic entry see Field 5C. W76-03650

W76-03661

FLUIDIZED BED FURNACE HAVING COARSE PARTICLE DISCHARGING DEVICE, Rheinstalh A.G., Dortmund (West Germany). For primary bibliographic entry see Field 5E

DESIGN AND OPERATION OF HIGH-RATE FILTERS-PART 1,

Montgomery (James M.), Inc., Pasadena, Calif. Water Treatment Div.

American Water Works Association Journal, Vol. 67, No 10, p 535-544, October, 1975. 7 fig, 3 tab, 35

Descriptors: \*Waste water treatment, \*Water treatment, \*Filtration, \*Filters, Equipment, Design criteria, \*Operation and maintenance, Economics, Costs, \*Poesign, Filter rates.

Identifiers: \*High-rate filtration.

Experience with high-rate filtration, available formulas, and design criteria are discussed in order to assist in economical filter design and operation. Topics covered include: historical development of filtration, degree of pretreatment necessary when using conventional rapid sand filters and reverse-graded filters; selection of the filter media; required filter media thickness relative to the media grain size; filter rate control; maximum head loss for filters; and, continuous turbidity monitoring. The main goal in filter design is to pro vide a facility for the steady production of high-quality water with minimum operational and maintenance costs. The new types of media, filter wash systems, chemicals for filter aids, or different concepts of filtration now available, require the use of new design criteria. Pretreatment and filtration are closely related; design of pretreatment facilities should depend on the type of filter employed. Selection of filter media should be based on the degree of purification required, the length of filter run, and ease of filter wash to remove lodges suspended matter from filter media. The absolute minimum depth of total filter media should be 300 m in order to provide a safety factor against breakthrough. Filter rate control is divided into five basic types: constant rate filtration; declining rate riltration; constant level filtration; equal loading filtration; and, constant pressure filtration. W76-03665

TERTIARY WATER TREATMENT. Plant Engineering and Technology, p 38, 1975.

Descriptors: \*Waste water treatment, \*Sewage treatment, \*Treatment facilities, \*Pilot plants, \*Tertiary treatment, Lime, Coagulation, Filtration, Chlorination, Ammonia, Phosphorus, Nutrient removal, Nitrogen, Activated carbon, Assertices Identifiers: BIOX rotating disc aerator.

Toray Engineering Company, Limited, of Japan has built an advanced waste water treatment pilot plant at their Shiga factory. The company plans to branch out into selling tertiary sewage and waste water treatment plant technology. The pilot plant was designed combining some of the technology developed by CH2M Hill with the BIOX rotating disc aerator developed by Toray Engineering. Waste water receives secondary treatment by means of the BIOX rotating disc aerator. Tertiary treatment includes lime coagulation, carbonate formation, filtration, break-point chlorination, and activated carbon adsorption. Ammonia-nitrogen is decreased to 0.2 ppm, BOD to 1-2 ppm, COD to 1ppm, SS to one ppm, and total phosphorus to 0.06 ppm. The treated water can be used as potable water after chlorination. The waste water is treated in the rotating disc aerator to a degree that is half-way between that of secondary and tertiary treated water. This decreases the consumption of activated carbon and lowers the operating costs Recycling of calcium carbonate, simplification of ammonia removal, and regeneration of activated carbon are also stressed in the treatment process The pilot plant costs \$330,000 and treats 60 tons of waste water from the cafeterias and dormitories of the Shiga factory. (Orr-FIRL)

MARSH MILLS-THE NEW WORKS TREATING SEWAGE FROM PLYMOUTH. Surveyor, Vol 146, No 4345, p 39-40, September

19, 1975. 2 fig.

Descriptors: \*Sewage treatment, \*Waste water Sewage teathers, Waste water treatment, \*Storm water, \*Treatment facilities, Automatic control, Pumps, Pumping plants, Automation, Aeration, Monitoring. Identifiers: Great Britain(Plymouth)

The first and second stages of the Marsh Mills sewage treatment works of the South West Water Authority (Great Britain) have been completed at a cost of 900,000 pounds. The first stage, primary treatment works, superseded the primary treat-ment facility built in 1957. The second stage provides secondary treatment and automatic control. The main problem with the design of the sedimentation tanks was flotation of the tanks because they extended 6.5 m below the normal ground-water level. Prevention of flotation is accomplished by a combination of pressure relief valves to prevent the ground-water from rising above a specific level when the tanks are empty, and ground anchors to resist the residual upthrust. The main pumphouse is a reinforced concrete frame building with brickwork infill walls. It contains two comminutors, two 250 mm and three 175 mm

main sewage pumps, two 200 mm diameter reciprocating sludge pumps, grit tank blowers and switchgear, and staff accomodations. There are standby sets for all pumps, blowers, and comminutors. Overall control of the works is from the pumphouse; most daily operations can be performed automatically. Automatic functions include: separation of storm water; monitoring and returning storm water to the main flow during low flow periods; sludge drawoff; sludge pumping and measurement; monitoring of return and surplus sludge; and, aeration control. Secondary treatment is provided by four Simplex aeration cones; the amount of aeration is controlled by dissolved oxygen electrodes in the tank. (Orr-FIRL) 76-03667

TEMPERATURE EFFECTS ON AEROBIC

DIGESTION KINETICS, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering. C. W. Rondall, J. B. Richards, and P. H. King. Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol 101, No EE5, p 795-811, October, 1975. 11 fig, 9 tab, 23 ref, 1 ap-

Descriptors: \*Waste water treatment, \*Activated sludge, \*Kinetics, Temperature, Aerobic conditions, Laboratory tests, Analytical techniques. Identifiers: \*Aerobic digestion.

Research was conducted to determine under controlled conditions the effects of a wide range of digestion temperatures on the aerobic digestion process and the subsequent dewaterability of the resulting digested sludges. Waste activated sludge was digested in batch reactors for 15 days at temperatures of 5, 10, 30, 35, and 45C. The selection of an optimum temperature depends on the principal goal to be achieved; however, neither 5 or 45C should be selected as an aerobic digestion temperature if batch reactors are used. The quality from the 20C reactor was slightly better, but there was little difference in quality from 10 to Stabilization of the mixed liquor was best at high temperatures. The oxygen required per unit volatile solids destroyed was lowest at the low temperatures. Optimum filterability occurred at a digestion temperature of 35C. Maximum solids destruction occurred in the 20C reactor. Generally, there was not much difference in the performances of the 20, 30, and 35C reactors. The kinetics of digestion were in good agreement with accepted temperature variation theory for the reactor temperatures at 20C and below. However, the values from the digesters operated at higher temperatures do not conform at all. Above 20C the endogenous destruction of waste activated sludge cannot be described as a chemical reaction; environmental factors and population dynamics considerations are more important. There seems to be no practical advantage to aerobic digestion tem-peratures higher than 20C. (Orr-FIRL) W76-03668

USE OF POLYELECTROLYTES FOR OVER-LOAD CLARIFIERS, McMaster Univ., Hamiliton (Ontario). Dept. of

Chemical Engineering.

A. Benedek, J.J. Bancsi, and J. W. G. Rupke. Journal Water Pollution Control Federation, Vol 47, No 10, p 2447-2460, October, 1975. 14 fig. 3 tab. 10 ref.

Descriptors: \*Polyelectrolytes, \*Overflow, Waste water treatment, Activated sludge, Descriptors: Supended solids, Phosphorus, International water, Laboratory tests, Chemical oxygen de-mand, Treatment facilities, Canada, United States, Great Lakes Region, Effluents, Nutrient Identifiers: \*Clarifiers, Alum, Hydraulic loading.

Agreement between Canada and the United States requires the removal of phosphorus by

#### **Group 5D—Waste Treatment Processes**

water treatment plants in the Lower Great Lakes Region. The batch settling properties of an alum polyelectrolyte waste water system is examined in the laboratory and the clarifier performance of predicted in full scale. Full-scale data with primary alum and polyelectrolyte addition ion the chosen water pollution control plant at overflow rates is ed to predict the maximum permissible botamed to predict the mannion permission permission hydraulic loading for a primary clarifier. The laboratory predictions are compared with the results of the full scale study. In the batch settling procedure, alum was added at the time zero, and then, five minutes later, the polyelectrolyte was added. The system was rapidly mixed for the first five minutes and slowly mixed the next fourteen minutes, after which samples were taken at preset intervals. This simulated the plant study, in which alum was added in one part of the line and polyelectrolyte was added further downstream. Samples were analyzed for total and filtered phosphorus, total and filtered chemical oxygen demand, and suspended solids. Samples were frozen for preservation, but this introduced about a 40% error into the suspended solids determination. The standards for effluent phosphorus concentration that had to be met were one mg/liter 80% of the time in jar tests and 50% of the time in plant operation. In the batch settling tests, alum with polyelectrolyte reduced phosphorus concentrations by 44% more than alum alone and increased overflow rates. In the activated sludge plant, the phosphorus, suspended solids and chemical oxvgen demands were reduced and the overflow rate was increased. (Pinto-FIRL) W76-03669

PROCESS CONTROL BY OXYGEN-UPTAKE

AND SOLIDS ANALYSIS,
Mississippi State Univ., Mississippi State. Dept. of

Civil Engineering.
L. D. Benefield, C. W. Randall, and P. H. King. Journal Water Pollution Control Federation, 47, No 10, p 2498-2503, October, 1975. 2 fig, 6 ref.

Descriptors: Oxygen, \*Solids contact processes, Waste water treatment, \*Activated sludge, Analy-sis, Sludge treatment, Microorganism, Mathematics. Control systems.

Identifiers: Process control, \*Oxygen-uptake, \*Solids analysis, Clarifiers, Sludge age, Sludge wasting, Substrate concentration.

The most common methods used by plant operathe most common memors used by plant opera-tors to control the activated sludge process are discussed. The theoretical basis for another method having certain advantages over the others was studied. Four control methods in common use are: sludge wasting to maintain a constant mass of organisms in the system; sludge wasting to maintain a constant specific rate of substrate utilization; sludge wasting to maintain a constant sludge age; and, hydraulic control to maintain a constant sludge age. The last two, in which the sludge age is kept constant, are the most favorable ones. major weakness in these methods is the continual shifting in the solids balance between the aeration tank and the clarifier as the influent flow rate deviates. A new method is proposed in which the solids separate at a rate such that the required solids concentration is maintained in the sludge return lines and no microbial growth occurs in the secondary clarifier. Advantages of this method in-clude: the effect of the fluctuating solids level in the secondary clarifier is minimized; any change in the influent substrate concentration will be influent substrate concentration will be reflected immediately in the oxygen uptake rate; and loading fluctuations can be compensated for by varying the interval between control periods. Disadvantages of this method include: the require-ment for a laboratory study to determine changes in the constants; more operator attention than is required in the hydraulic method for controlling sludge age; and mathematical manipulations are required than in any other of the methods. (Pinto-FIRL) W76-03670

DYNAMICS OF NITRIFICATION IN THE AC-TIVATED SLUDGE PROCESS,

Tennessee Eastman Co., Kingsport. R. A. Poduska, and J. F. Andrews.

In: Proceedings of the 29th Industrial Waste Conference, May 7-9, 1974, Lafayette, Indiana, Purdue University, p 1005-1025, 15 fig, 8 tab, 36 ref.

Descriptors: \*Nitrification, \*Activated sludge, \*Waste water treatment, Nitrate, Nitrite, Nitrogen, Ammonia, Mathematical models, Continuous flow, Dissolved oxygen, Bacteria, Indus-trial wastes, Domestic wastes, Sludge treatment, Oxidation. Identifiers: Monod relationships

The transient responses of a nitrifying activated sludge process to various dynamic forcings in continuous flow laboratory scale reactors were stu-died. A dynamic model of nitrification in the activated sludge process was developed and verified with data taken in the study. Two types of bacteria are responsible for nitrification: Nitrosomonas oxidizes ammonium to nitrite, and Nitrobacter ox-idizes nitrite to nitrate. These bacteria survive well in domestic wastes but not in industrial wastes because of growth inhibiting chemicals and adverse pH conditions. Proper sludge age, pH, temperature and dissolved oxygen concentration are necessary for the survival of the bacteria. Stochiometric analysis was performed to determine the necessary dissolved oxygen concentration. A kinetic mathematical model provides a theoretical basis for nitrification. The dynamic model in the study uses the Monod relationship between specific growth rate and substrate con-centration. The differential equations are solved by computer. Three identical systems were used to test the dynamic model. The temperature was kept at a constant 23C and the pH was kept at a constant 7.2. A mixed culture of nitrifying bacteria and heterotrophic bacteria was used. The dynamic model adequately represents the dynamic responses of nitrification in the experimental system for various input forcings. Sludge age is the basic parameter for determining the degree of nitrificawith an activated sludge system. (Pinto-FIRL)

OZONE FIGHTS ODORS.

ater and Wastes Engineering, Vol 12, No 10, p 39. October, 1975

Descriptors: \*Ozone, \*Odor, \*Waste water treatment, \*Sewage treatment, \*Treatment facilities, Equipment, Sewage effluents, Georgia.

An odor control system has been installed in a new 20 mgd sewage treatment facility in Savannah, Georgia. The Savannah Water Pollution Control plant handles about 12 mgd of sewage effluent. Approximately 30,000 cfm of air containing gas and odors is drawn off the screen room and grit chambers through fiberglass ducts and fed into a contact chamber. Ozone is injected into the air stream, with a contact time of about 6.3 seconds. Ozonated air is exhausted into the atmosphere through a duct in the ceiling of a chamber. Any airborne sulfides, amines, or mercaptans are oxidized and the exhausted air is odorless and germfree. The oxonator for this facility uses atmospheric air, and produces over 25 lb/day of ozone. Ozone is discharged from the ozonator at a pressure between 3 and 7 psig, through stainless steel pipe directly into the exhaust duct. (Kramer-FIRL) W76-03673

ELECTROLYTIC DEPHOSPHORATION AND DENITRATION.

Plant Engineering and Technology, p 38, 1975.

Descriptors: \*Denitrification, \*Nutrient removal, \*Electrolysis, Tertiary treatment, Activated sludge, \*Waste water treatment, Adsorption, Phosphorus, Nitrogen, Adsorption. Identifiers: \*Dephosphoration.

A new technology for removing phosphorus and nitrogen compounds from sewage and plant waste water has been developed in Japan. Electrolysis is used to change the phosphorus and nitrogen compounds contained in water into non-watersoluble sludge, with a nearly 100% removal rate. Waste water is electrolyzed while being mixed with activated diatomaceous earth obtained from electrol-ysis and sea water which has been subjected to preliminary electrolysis at a pH below seven. Phosphorus compounds and ammonia are absorbed on the activated diatomaceous earth. Phosphorus compounds are changed into calcium phosphate by reaction with calcium compounds dissolved in the water. Previous methods of tertiary treatment have included: a body-feed method in which activated carbon powder is used as adsorbent, a method making use of synthetic zeolite adsorbent, and a method using a anthracite adsor-bent. These cost about 30 yen per ton of water to be treated. In comparison, the electrolysis method costs less than ten yen for one ton of waste water and operates very quickly. (Kramer-FIRL) W76-03675

WASTE SLUDGE TREATMENT WITH PRES-SURE FILTRATION,

Passavant Corp., Birmingham, Ala. H. W. Forester.

Filtration Engineering, Vol 6, No 6, p 9-12, September/October, 1975. 3 fig, 1 tab.

Wastes, Pressur.
Dewatering, \*Sludge, Descriptors: "Sludge, Wastes, Fressure, Filtration, Waste treatment, Dewatering, Groundwater, Leachate, Cost analysis, "Waste water treatment, Waste disposal, Suspended solids, Landfills, Separation techniques, "Sludge

Identifiers: Filter cakes, Filtrate, \*Pressure filtra-tion, Vacuum filtration, Liquid-sold separation, High pressure filtration.

iquid-solid separation requires a force to drive the liquid through the accumulated solids. Pressure filters require a pressure differential from sure filters require a pressure differential from three atmospheres to a multiple of that force for operation. For higher multiples, the term high pressure filtration is often used. This term is misleading in that it implies danger to personnel and high operating costs. The inaccuracy of this myth is despelled in this study. Two methods of filter cake disposal are discarding it on a landfill and incinerating it and discarding the ash on a landfill. Higher pressure produces higher solids concentration in the filter cake, resulting in lower hauling costs. Also, since filter cake is scrutinized from the standpoint of leachate and groundwater from the standpoint of leachate and groundwater contamination, it can be assumed that filter cake vith higher solid concentrations will have leachate. Another consideration is that higher pressure will increase the filter capacity, thus decreasing landfill costs. If the filter cake is to be incinerated, then the higher pressure will increase the solids concentration, causing the filter cake to burn more efficiently. A particular advantage of pressure filtration is the relatively clear filtrate that is produced. The suspended solids count is about twenty times less than the filtrate produced by vacuum filtration. Other process problems to be solved in a dewatering plant include pumping the viscous and abrasive sludge at a constant flow rate, which can be solved by using a mechanical feed pump with an equalizing tank, and construct-ing conveyors and operating valves at the correct time. (Pinto-FIRL) W76-03676

DRY SPREADER SOLVES SEWAGE TREAT-MENT PLANT PROBLEMS.

For primary bibliographic entry see Field 5E. W76-03677

FROM LAGOONING TO FARMLAND APPLI-CATION: THE NEXT STEP IN LIME SLUDGE DISPOSAL, G. A. Russell. American Water Works Association Journal, Vol. 67, No 10, p 585-588, October, 1975. 4 fig, 3 tab.

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Descriptors: \*Waste disposal, \*Sludge disposal, \*Water treatment, \*Waste water treatment, \*Economics, Dewatering, Agriculture, \*Lime, Lagoons, Recycling, Neutralization, Illinois. Identifiers: \*Dry spreader, Land application.

The water-waste management program for the Champaign-Urbana community in Illinois is described. Because of the hardness of the water, lime-softening operations have been used since 1961 to reduce the hardness to 80 mg/liter. The lime-softening sludge had been deposited in lagoons, but as the population has increased, the original lagoons have been expanded. Presently, there is a lack of available land, and an alternative was sought to aid or eliminate the lagooning process. Recalcination and reuse was not an economically feasible alternative, and geographical limitations made discharge to a watercourse impractical. The solution found was that of application of naturally dewatered lime sludge to farmland. Because the soil of this area is acidic from nitrogen-ammonia fertilizer application, it is necessary to neutralize it periodically. A test performed on Champaign-Urbana lime sludge in-dicated that it was 94.9% effective as pure calcium carbonate. Handling the application of lime sludge may be achieved with a dry spreader, originally designed for waste water sludge disposal. Experiments with this spreader showed that naturally dewatered lime sludge may be hauled in bulk and stored near the field prior to application. The spreader may then be filled at the site, thus eliminating travel time between the lagoon and the field. The new technique will probably be imple-mented in the near future. (Kramer-FIRL) W76-03678

DEVELOPMENTS IN SEWAGE TREATMENT

AT LEEDS, Yorkshire Water Authority (England). North Central Div

J. A. Hudson, and G. A. Phillips.

Water Pollution Control, Vol 74, No 5, p 544-559, 1975. 9 fig, 10 tab, 6 ref.

Descriptors: \*Sewage treatment, \*Waste water treatment, \*Treatment facilities, Activated sludge, Sludge treatment, Filtration, Filters, Pumping, Sludge treatment, Sludge disposal, Costs, Water quality standards. Identifiers: Leeds(Great Britain).

The most recent developments in the modernization of Knostrop sewage works in Leeds, Great Britain, are detailed. The main objective was to build a plant capable of producing an effluent to meet River Authority standards. The plant in ex-istence had been built 56 years ago and depended upon manual operation. Improvements (due to the high cost of labor) therefore, necessitated some degree of automation. In the past two years, an activated sludge plant, heat treatment plant, and incinerator have been put into operation. In addi-tion, major changes have been made in the biological filters and obsolete pumping equipment has been replaced. New reconstruction has also begun of the high-level inlet works. The major problems encountered have been related to sludge treatment and disposal. (Kramer-FIRL) W76-03679

INFLUENCE OF COLLOIDAL PARTICLES ON DEWATERING OF ACTIVATED SLUDGE WITH POLYELECTROLYTE,

Swedish Inst. for Surface Chemistry, Stockholm. K. Roberts, and O. Olsson. Environmental Science and Technology, Vol 9, No 10, p 945-948, October, 1975. 5 fig, 21 ref.

Descriptors: \*Polyelectrolytes, \*Dewatering, Activated sludge, \*Sewage treatment, Waste water treatment, \*Colloids, Cations, Polymers, Sludge, Flocculation. Identifiers: Capillary Suction Time.

Problems in finding the best polyelectrolyte and in controlling polyelectrolyte dosage under different operating conditions have occurred with sludges biological origin. The dewatering of activated sludge samples with solids contents under 1% was studied using Capillary Suction Time techniques and a cationic polyelectrolyte for flocculation. It was found that the polelectrolyte dosage for op-timal dewatering was independent of the original solids content of the sludge. The dosage also corresponded to the amount of polyelectrolyte required to obtain a zero charge on the anionic colloidal particles in the sludge. It was further show that the negative charge on the colloidal particle could be partially neutralized using a metal hydroxide rather than a cationic polyelectrolyte. This reduced the polyelectrolyte requirement for dewatering of the total sludge correspondingly. Dewatering of low-solids activated sludges from domestic sewage treatment plants with cationic polyelectrolyte can be determined largely by interactions between the cationic polyelectrolyte and the colloidal materials in the sludge. The mechanism of dewatering is probably a cross-linking of the added cationic polyelectrolyte with the natural anionic monomers and polymers in the sludge. (Kramer-FIRL) W76-03680

CANADIAN WASTEWATER PLANT FEA-

TURES MANY FIRSTS. Public Works, Vol 106, No 11, p 58-59, November, 1975. 3 fig.

Descriptors: \*Waste water treatment, \*Activated sludge, \*Treatment facilities, \*Sewage treatment, Pilot plants, Biological treatment, Industrial wastes, Sludge treatment, Incineration, Waste water disposal, Sludge disposal, Methane, Identifiers: Hamilton(Ont).

The secondary treatment phase of the waste water treatment facility for Hamilton, Ontario, was completed in 1974 at a cost over \$25 million. Activated sludge treatment, pressure flotation for ex-cess activated sludge thickening, additional digester, filter and boiler capacities, sludge in-cineration, standby power facilities, and landscap-ing were added in this phase. The plant includes many innovative design features such as four 83 inch diameter Archimedean pumps. Plant capacity is 60 million imperial gallons per day (migd), with is 60 million imperial gallons per day (migd), with some components having a hydraulic capacity of 120 migd for expansion. A 5,000 igpd pilot plant is used for studying the effects of biological treatment of industrial wastes discharged to the sewer systems, and for determining the effectiveness of nutrient removal processes. The chlorinated secondary effluent is discharged to the Hamilton Bay. Sludge is conditioned with polyelectrolytes, subjected to pressure flotation, digested, filter pressed and then inciperated in one of two circupressed, and then incinerated in one of two circular, mechanically rabbled, multiple hearth air cooled incinerators. Methane gas from the sludge digestion process is the main combustion fuel. W76-03681

LOOP AERATION TANK DESIGN OFFERS PRACTICAL ADVANTAGES, PART I, Metcalf and Eddy, Inc., Palo Alto, Calif

A. Jacobs Water and Sewage Works, Vol 122, No 10, p 74-75, October, 1975. 2 fig, 6 ref.

Descriptors: \*Activated sludge, Aeration, \*Treatment facilities, Flow, \*Waste water treat-ment, Mixing, Oxygen, \*Design criteria, Compu-Aeration. ters, Equipment. Identifiers: \*Carrousel aeration system, \*Aeration

The Carrousel aeration system (used in Europe since 1968) is a hydraulic variation of the activated sludge process that uses the hydraulic properties of a mechanical aerator to maintain adequate velocity and turbulanec necessary for suspension of MLSS in deep channels with only a limited expenditure of energy. It combins plug flow and complete mix, and was developed as an economical alternative to the oxidation ditch. The Carrousel aeration tank is a mechanically aerated continuous channel. Oxygen is supplied to the mixture by a conventional vertical shaft, mechanical aera tor at the influent end of the channel. The tank contents make one revolution through the channel every 10-30 minutes. An amount equal to the influent flow is constantly displaced over the ef-fluent weir. The following steps must be followed in order to size the Carrousel system. The oxygen requirement and tank volume must be determined for a particular waste based on the food to mass (f/m) ratio, solids retention time, BOD, and flow. The type of mechanical aerator that can maintain the required channel velocities and oxygen content is chosen. The aeration tank aerator section and channel dimensions are then determined based on the aerator type selected. The channel depth is normally about 1.1 times the impeller diameter, while the channel width is about 2 times the channel depth. The channel length is determined based on the required volume, channel depth, and width. A computer program can then be used to optimize the dimensions for the particular aerator chosen and the tank volume. (See also W76-03683) (Orr-W76-03682

LOOP AERATION TANK DESIGN OFFERS PRACTICAL ADVANTAGES, PART II. Metcalf and Eddy, Inc., Palo Alto, Calif.

A. Jacobs

Water and Sewage Works, Vol 122, No 11, p 74-75, November, 1975. 4 fig, 2 tab, 6 ref.

Descriptors: \*Activated sludge, \*Waste water treatment, Aeration, Nitrification, Denitrification, \*Design criteria, Treatment facilities. Identifiers: \*Carrousel aeration system, \*Aeration

The Carrousel aeration system has several advantages over conventional aeration tank configurations. The fact that the effluent must make at least one loop through the tank before any portion of it can be discharged eliminates short-circuiting. Buffering capacities are provided that are similar to those afforded by complete mix designs. The relatively small number of aerators reduces the maintenance costs and capital costs. Not all the aerators must be operated to provide adequate channel velocities during low-flow periods which reduces electrical consumption. The Carrousel process requires less oxygen than complete mix processes at the same loading which achieves about a 10% power savings. The mechanical shaft, surface aerator used in current installations is economical, efficient, reliable and durable. Slow speed aerators are generally employed. The Carrousel system can combine nitrification and denitrification in one system. If the dissolved oxygen concentration is one of the channel reaches is maintained close to zero mg/liter, then denitrifiers present in this reach will become active and reduce the previously nitrified waste. Raw sewage is used the carbon source for denitrification which eliminates the need for methanol addition. A 12 day sludge age is necessary to maintain the nitrifiers and denitrifiers in the system. As of September 1973, there were 19 Carrousel plants operating in the Netherlands, 19 operating in France, and another 67 either under construction or being designed. Some of the operating data for a plant in Lichtenvoorde, Netherlands, is graphically presented. (See also W76-03682) (Orr-FIRL) W76-03683

#### **Group 5D—Waste Treatment Processes**

EFFICACY OF BIOLOGICAL NITRIFICATION, McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
P. M. Sutton, K. L. Murphy, B. E. Jank, and B. A.

Monaghan.

Journal Water Pollution Control Federation, Vol 47, No 11, p 2665-2673, November, 1975. 7 fig, 4

tab. 11 ref

Descriptors: \*Waste water treatment, \*Activated sludge, \*Nitrification, Biological treatment, Pilot plants, Temperature, Nitrogen, Ammonia. Identifiers: Solids retention time, Alum.

Pilot plant studies were performed on carbon removal and nitrification efficiencies obtained from three differently organized activated sludge treatment processes. These included single- and two-state combined sludge systems and a two-stage separate sludge system. Nitrification, under of operating temperatures, and solids retention time (SRT) at pseudo steady-state condi-tions were compared. The effects on nitrification of ferric chloride and alum addition to a combined sludge nitrification system were recorded. SRT and temperature were the primary factors affecting performance. SRT levels were chosen on the basis of practical design considerations for full-scale facilities. Temperature levels represented values at which treatment plants can work in continental climates. Results indicate that, under pseudo steady-state conditions, separate and combined sludge systems remove equal amounts of filterable total nitrogen at equal system SRT's. Nitrification is independent of mixing and reactor organization in combined sludge systems. Nitrification rate is more sensitive to temperature than the rates for organic removal; temperature sensitivity is reduced with increasing SRT in combined and separate systems; in a separate system, a minimum system SRt of 10 days is required in order to obtain complete nitrification at temperatures nearing 5 C. Adding inorganic chemicals to a nitrifying activated sludge plant at dosages that reach one mg per liter effluent total phosphorous concentrations does not seem to adversely affect nitrification rate. (Waltner-FIRL) W76-03684

PULSE TRANSFER GIVES THICKER SLUDGE. Dorr-Oliver, Inc., Stamford, Conn. Environmental

Applications.
J. B. Rosenquest, Jr.
Water and Waste Engineering, Vol 12, No 10, p 37-39, October, 1975. 1 fig, 1 tab

Descriptors: \*Pumping, \*Pumps, \*Sludge treat-\*Waste water treatment, Hydraulics, Dewatering.

Identifiers: Diaphragm pumps, Pulse transfer.

Pulse transfer for moving sludge has been used for more than 7 years at the Hatfield, Pennsylvania, sewage treatment plant and in a series of tests at the Salisbury, Maryland, treatment facility. In pulse transfer, sluge is moved by a diaphragm pump with short intermittent pumping cycles. A spring or vaccum assist has been added to the pump design to provide the pulsing characteristics necessary for moving sludge. Two No. 4 ODS pumps are used at the Hatfield facility to move a combination of primary, secondary, activated, and chemical sludges through a eight inch diameter line. Although the average velocity in the pipe is only one and three-eighths inches, the pulse peak velocity of three feet per second maintains the settleable solids in suspension. The diaphragm pumps have required little maintenance; the diaphragms have been replaced only once in 7 years. The tests conducted at the Salisbury plant determined the effect of pulse transfer on sludge consistency. No dilution occurred if the sludge was allowed to compact in the hopper. Two-minute pulses aided compaction. However, continuous operation reduced the solids content by causing unsettled solids to be drawn off from the upper, less dense portion of the sludge blanket. The beneficial effects of

denser sludges include: a reduction in gallons pumped for a given quantity of suspended solids; lower fuel costs for incineration; and, more effi-cient dewatering filter operation. Pulse transferring removes the thickest available sludge from the hopper as it forms. The withdrawal rate matches the settling rate in the hopper. The density of the sludge can be controlled by manual or automatic means. (Orr-FIRL)

NEW PLANT CUTS PHOSPHATES

Water and Wastes Engineering, Vol 12, No 10, p 49. October, 1975.

Descriptors: \*Waste water treatment, \*Sewage treatment, \*Treatment facilities, \*Sludge treatment, Sludge disposal, Incineration, Dewatering, Centrifuges, Chlorination, Nutrient removal, Phosphorus, Biochemical oxygen demand, Regional planning, Pennyslvania.
Identifiers: Lower Allen Township(Pa).

A new regional waste water treatment plant has been built by Lower Allen Township, near Harrisburg, Pennsylvania, to replace the original one mgd primary plant built in 1957. Upper Allen Township and the State Correctional Institution at Camp Hill will also share in the cost and use of the facilities. The waste water is pumped through a distribution chamber to primary clarifiers which provide both gravity and chemical treatment. Pebbled lime is fed into the clarifiers to remove the phosphorus. Secondary treatment is performed in four aeration tanks; further settling and clarification occur in two final clarifiers. Final treatment is chlorination after which the treated water is released into the Susquehanna River. Sludge is treated in a four step process comprising: degritting by a cyclone process; dewatering in one of the two sludge thickeners; further dewatering in one of two centrifuges; and, incineration in an oil-fired seven level furnace. The process removes 80% of the phosphorus and 85% of the BOD. (Orr-W76-03686

THE MOST FROM THE FINAL CLARIFIERS.

Waukesha, Wis Envirex Inc.,

W. H. Boyle Water and Wastes Engineering, Vol 12, No 10, p 53-55, 82, October, 1975. 4 fig.

Descriptors: \*Waste water treatment. \*Activated sludge, Hydraulic machinery, Hydraulics, Sludge, Design.

\*Clarifiers. Hydraulic removal Identifiers: mechanisms, Sludge return.

The final clarifier performs one of the most important unit functions in the activated sludge process The hydraulic removal mechanism, sometimes called a vacuum or suction type device, is the preferred sludge collection mechanism when dealing with a light flocculant sludge. A brief review is presented of the main requirements for a hydraulic removal mechanism which are rapid sludge removal, minimum sludge agitation, maximum solids concentration, flexibility, and balanced hydraulic design. One of the two main types of circular hydraulic removal mechanisms is a rectangular tapered header made of 0.25 inch steel plate with orifices drilled into the header for the removal of sludge (the header design). The other device incorporates several withdrawal pipes with the sludge channeled by deflector plates to these pipes and transported to collection wells (riser pipe design). The hydraulic design of each of these devices is explained. The choice of hydraulic sludge removal mechanism should be based on performance, how the device affects the main process requirements, and an economic evaluation of capital and operational/maintenance expenditures. (Orr-FIRL) W76-03687

OXYGEN TRANSFER EFFICIENCY IN DEEP TANKS,

Sanitaire Water Pollution Control Corp., Milwau-

F. L. Schmit, and D. T. Redmon

Journal Water Pollution Control Federation, Vol 47, No 11, p 2586-2598, November, 1975. 8 fig, 2 tab. 15 ref.

Descriptors: \*Waste water treatment, Aeration, \*Treatment facilities, \*Oxygenation, Design criteria, Oxygen requirements.

Identifiers: \*Aeration tanks, Oxygen transfer effi-

An investigation was conducted to determine the relationships of oxygen transfer efficiency and power and air requirements to submergence in coarse bubble, wide band aeration systems. Methods used to measure oxygen transfer were also examined. The tests were conducted in a tank that was 34.33 ft wide X 6 ft long X 24 ft deep. Water depths up to 23 ft were used. The aeration system was a rotary positive blower driven by a 20 hp electric motor through a V-belt drive. The value of the dissolved oxygen saturation value (C(sat)) used in determining the mass transfer coefficient and the respective oxygen absorption had a signifi-cant effect on the results obtained. Determining C(sat) by obtaining the equilibrium or asymptotic DP value under test conditions was a reliable and reproducible method. The relationship of percentage oxygen absorption to submergence varied between the 0.76 and 1.08 power of submergence depending on whether air per unit volume or total air applied was held constant with varying water depths. If the water depth and submergence were fixed, then increased air rate resulted in an increase in percentage oxygen absorption and transfer capability. The advantages of deep tank construction, such as reduced area requirements and less air compressing and distribution equip-ment, may be obtained with a decreased in the power necessary to transfer the required oxygen. An economic evaluation of aeration tanks deeper than 15 ft should be included in the design stages of a facility as well as a consideration of the per-formance under peak demand conditions. (Orr-W76-03691

HIGHER SPEED MAY LOWER PROBLEMS,

Versar, Inc., Springfield, Va. D. H. Houck, and R. J. Weis. Water and Wastes Engineering, Vol 12, No 10, p 32-34, October, 1975, 4 fig. 2 tab.

Descriptors: \*Aeration, \*Equipment, \*Mixing, \*Mechanical engineering, \*Waste water treatment, Oxygenation, Mechanical equipment, Baffles, Impellers. Identifiers: \*High-speed aerators.

With proper understanding of the mechanics involved and suitable engineering for each installa-tion, high speed aerators can be an economical solution to waste water treatment problems. The direct high speed aerator is essentially an axial flow pump with a 360 degree discharge. This aerator offers substantial improvement in design simplicity and ease of application over previous gear driven aeration units, resulting in relatively low capital and maintenance costs. Mixing and oxygen transfer efficiency are a function of proper design.
The oxygen transfer and mixing are accomplished by raising the pumped liquid to a relatively high kinetic energy state andthen impinging it on the surface of the basin at a sufficiently flat angle so that the energy is efficiently transferred to the body of liquid surrounding the unit. Particularly significant internal pump design characteristics include inlet and exit hydraulic configuration, impeller design, and operation speed. All other things being equal, the aerator which uses a lower speed motor, larger discharge volute diameter, and the greater number of blades on the impeller will a higher capacity and be more efficient. In addition

to good mechanical and hydraulic design, the unit must be applied in such a manner as to maximize its performance in a given waste treatment system.

Examples of a proper design configurations are given. Baffles may be installed to assist the mixing in completely mixed reactive vessels. (Orr-FIRL) W76-03692

FORMATION OF ORGANOCHLORINE COM-POUNDS FROM THE CHLORINATION OF A MUNICIPAL SECONDARY EFFLUENT, North Texas State Univ., Denton. Inst. for En-

vironmental Studies W. H. Glaze, and J. E. Henderson, IV

Journal Water Pollution Control Federation, Vol 47, No 10, p 2511-2515, October, 1975. 3 fig, 1 tab,

Descriptors: \*Chlorination, \*Organic compounds, \*Waste water treatment, \*Effluents, Sewage treatment, Analytical techniques, Water analysis. Laboratory tests, Public health, Pollutant identifi-cation, Gas chromatography.

Identifiers: Superchlorination, Organochlorine compounds

The use of 'superchlorination', or using a much larger chlorine dosage than usually required for specialty applications, of waste waters or waste products was found to yield significant quantities of new chlorinated organics. There has been a great deal of concern about the possible deleterious effects of such compounds on receiving streams and on chronic health effects should such compounds enter potable water supplies. In a laboratory investigation, grab samples from a sewage treatment plant were collected and treated with a chlorine dose of 1500 mg/liter. Chlorinated and control waste water extracts were analyzed by gas chromatography. Most of the compounds identified were aromatic derivatives. A qualitative-quantitative analysis of the chlorinated organics found in the waste water effluent was presented in a table. Concentrations of the compounds (in the microgram per liter range) agreed with previous research in this area. Further work is in progress to determine if any of the chlorinated acetone derivatives found might be precursors of chloroform. Other research is underway, using microcoulometric methods to determine the total organic-bound chlorine content in chlorinated secondary effluent. (Kramer-FIRL)

TRACE ELEMENTS IN BIOLOGICAL WASTE TREATMENT WITH SPECIFIC REFERENCE TO THE ACTIVATED SLUDGE PROCESS.

The ACTIVATED SLUDGE PROCESS, California Univ., Davis. D. K. Wood, and G. Tchobanoglous. In: Proceedings of the 29th Industrial Waste Con-ference, May 7-9, 1974, Part 2, Lafayette, Indiana, Purdue University, p 648-661.

Descriptors: \*Trace elements, \*Biological treatment, \*Waste treatment, \*Activated sludge, \*Waste water treatment, Microorganisms, Legislation, Domestic wastes, Industrial wastes, Domestic water, Enzymes, Growth rates, Metabolism, Bacteria, Treatment facilities, Surface runoff, Adsorption, Chelation, Chemical precipitation.

Identifiers: Complete-mix activated sludge process, Sacramento County(Calif), Municipal or-

dinances, Sewer infiltration.

The significance of trace elements in biological waste treatment is discussed, with specific reference to the activated sludge process. The role of trace elements in waste water is reviewed. They are required for the growth and metabolism of microorganisms. Microbial growth can be con-trolled by controlling their concentrations. It has not been possible to establish the specific trace element requirements of microbial populations in waste water treatment processes. Trace elements found in waste water depend on their source and

the removal mechanisms in the waste stream. The most significant source is domestic water supply The requirements of municipal ordinances limit the contributions of domestic additions and industrial discharges. Other sources include surface runoff and sewer infiltration. Removal mechanisms include adsorption, hydroxide precipitation, hydrogen sulfide precipitation and chelation. In the activated sludge process it was found that the following requirements of trace elements must be met: trace elements needed to activate enzymes responsible for degrading the waste must be present; those responsible for growth and metabolism must be present; their concentrations must be in balance with that of the wastes; and, the concentration must be high enough for cells to concentrate and use them. A study conducted on the Sacramento County complete-mix activated sludge process is discussed. Results show that deficiencies of certain trace elements can be a factor in producing the proper types of bacteria es-sential for waste treatment. These elements must be considered in designing new treatment systems. (Pinto-FIRL)

OZONATION OF WATER: ROLE OF HYDROXYL RADICALS AS OXIDIZING INTER-MEDIATES,

Eidegenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland)

For primary bibliographic entry see Field 5F. W76-03703

CHECK THAT PH, Fisher Controls Co., Marshalltown, Iowa. C. Cho.

Water and Wastes Engineering, Vol 12, No 10, p 70-71, October, 1975. 8 fig.

\*Waste Descriptors: \*Waste water treatment, \*Neutralization, Equipment, \*Hydrogen ion concentration, Mixing, Acidity, Alkalinity, Acid-base equilibriums, Control systems, Control, Analytical techniques.

Controlling pH is one of the most important operations in any waste water treatment process. How-ever, control of alkalinity or acidity is difficult because pH is a nonlinear function of the proportions of components in a solution, and extremely high gain occurs near the neutral point. Titration curves are illustrated that show the effects of neutralizing agents on acids and bases. These curves are the basis for pH control system design and must be defined for each application. Another problem with pH control is that the process usually involves mixing large quantities causing long time constants. The lags can be minimized by using small tanks to reduce transport delays and permit good mixing. However, the tank must be sufficiently large so that hold-up is long enough to allow the reaction to be completed. If fluctuations around the desired point can be tolerated, then onoff control systems can be effective. Simple feed-back loops based on specially-designed nonlinear pH controllers are satisfactory for most applications. The controllers are proportional-integralderivative elements. If the controller is set to correspond with the steeply sloped titration curve, then the net open-loop gain of the controller and process is essentially made linear. An example of a simple continuous pH control system is schemati-cally illustrated. (Orr-FIRL) W76-03704

REACTORS ROTATING BIOLOGICAL REMOVE NUTRIENTS, PART I, SIECO, Inc., Columbus, Ind.

O. Hao, and G. F. Hendricks. Water and Sewage Works, Vol 122, No 10, p 70-73, October, 1975. 3 fig, 3 tab.

Descriptors: \*Waste water treatment, \*Pilot plants, \*Biological treatment, Biochemical oxygen demand, Suspended solids, Treatment facilities. Identifiers: \*Biological rotating discs.

A pilot plant study conducted at the Columbus, Indiana, sewage treatment plant, demonstrated that rotating biological reactors can efficiently remove BOD, suspended solids (SS), and ammonia nitrogen from waste water. A full-scale plant was designed based on the results of this pilot study. The pilot bio-disc unit consisted of a 24-in module containing 36 bio-discs with a total media surface area of 250 sq ft arranged in four stages. The results of the pilot test are presented. BQD removal, generally effective and improved by chemical addition, was adversely affected by direct chemical addition on the bio-disc fourth stage tank, waste activated sludge from the primary clarifiers, and rotating speeds greater than 8 rpm. The BOD removal efficiencies were independent of the influent BOD concentrations. Suspended solids were removed effectively by the system when ferric chloride was added. Suspended solids removal was affected by the same factors as BOD removal. (See also W76-03713) (Orr-FIRL) W76-03712

ROTATING BIOLOGICAL. REACTORS REMOVE NUTRIENTS, PART II, SIECO, Inc., Columbus, Ind.

O. Hao, and G. F. Hendricks. Water and Sewage Works, Vol 122, No 11, p 48-50, November, 1975. 7 fig, 2 ref.

Descriptors: \*Waste water treatment, plants, Phosphorus, Nitrogen, Ammonia, Nutrient removal, Treatment facilities, Nitrification, Denitrification, Sewage treatment, \*Biological treatment. Identifiers: \*Rotating biological discs.

A pilot plant study conducted at the Columbus, Indiana, sewage treatment plant demonstrated that rotating biological reactors can efficiently remove BOD, suspended solids (SS), and ammonia nitrogen from waste water. A full-scale plant was nitrogen from waste water. A tull-scale plant was designed based on the results of the pilot study. BOD, SS, ammonia nitrogen, and phosphate removals with the addition of alum, or ferric chloride were examined. Phosphate removal increased by adding alum directly to the fourth stage of the rotating disc; however, this adversely af-fected BOD and SS removals. The selected alum concentration was 100 mg/liter; optimum polymer dosage to complement this alum dosage was 0.25 to 0.75 mg/liter. Total nitrogen removal could not be balanced due to the lack of Kjeldahl nitrogen analysis. Therefore, the extent of nitrification and denitrification could not be determined. The ammonia nitrogen removal results were excellent. (See also W76-03712) (Orr-FIRL) W76-03713

WASTEWATER TREATMENT WORLDWIDE, Water Victorian Commission, melbourne (Australia).

Australian Chemical Engineering, Vol 16, No 7, p 5-7, July, 1975

Descriptors: \*Waste water treatment, \*Sewage treatment, \*Reviews, \*Equipment, Rivers, Effluents, Demineralization, Ozone, Chlorination, Activated sludge, Dissolved oxygen, Municipal wastes, Filtration, Biological treatment. Identifiers: Physico-chemical treatment.

A review of new waste water treatment technologies in various countries is presented. In Sin-gapore, an island republic, a very sophisticated pilot plant for physico-chemical treatment has been designed which will treat raw sewage for direct reuse. The process includes lime treatment and ammonia stripping, filtration, carbon adsorp-

#### **Group 5D—Waste Treatment Processes**

tion, demineralization, ozonization, and chlorination. In Great Britain, the trend has been to replace small treatment facilities with larger regional plants which serve more than 100,000 persons. Ef-fluent from inland sewage treatment works is usually discharged to watercourses which supply water to downstream users. Thus, standards for nitrates, BOD, and suspended solids have become quite stringent. In the Ruhr area of Germany, rivers are managed on a catchment basis with dis solved oxygen being an important parameter. Sewerage systems in Switzerland are operated by municipalities; plant use either activated sludge, biological filtration or just primary screening and sedimentation. In Holland, sewage treatment standards are based on achieving dissolved oxygen in the effluent. Biological treatment with two stage high rate filters is common. In Australia, differing climatic, financial, legislative, and political condi tions apply for the various parts of the country. The most frequently used methods of treatment include Imhoff tanks with low rate trickling filters, stabilization lagoons, separate sedimentation and sludge digestion with high rate filtration, and activated sludge plants. (Kramer-FIRL) W76-03714

STUDIES ON THE ADSORPTIVE EFFECT OF ACTIVATED CHARCOAL ON POLYCHLORINATED BIPHENYLS IN WATER (YOZON PCB NO KASEITAN KYUCHAKU SHORI NI KANSURU KENKYU), For primary bibliographic entry see Field 5F. W76-03715

NEW PLANT SOLVES SEASONAL PROBLEM, Kupper (Charles J.), Inc., Piscataway, N. J. H. S. Allen, and D. R. Flett. Water and Wastes Engineering, Vol 12, No 10, p 23-25, October, 1975. 1 fig.

Descriptors: \*Sewage treatment, \*Ozone, \*Control systems, Computers, Sludge treatment, Treatment facilities, \*Waste water treatment, Digestion tanks, Odor, New Jersey, Seasonal.

Problems due to seasonal variations in sewage flow at a secondary treatment plant at Ortley Beach, New Jersey, were solved by a combination of ozone and automation. The treatment facility, located close to homes in a recreational community, was expanded from its 6 mgd primary capacity to a 12 mgd secondary capacity. Main components of the new system are a main influent pump station with mechanical bar screens and grinders. Sludge production in winter is about 60% of the summer load. The secondary digester is used as a holding tank, allowing the final step in sludge treatment (vacuum filtration) to proceed at a constant rate. Following digestion, air from primary, aeration, and sludge thickening tanks is fed to an ozone building for odor control treatment. Two ozone generators each produce 17 lbs ozone per day. Operations of the treatment process are monitored by an analog computer system which also provides data on the plant operation. (Kramer-FIRL) W76-03716

WASHINGTON SEWAGE WORKS: DESIGN AND OPERATION,

Washington Development Corp., New Town of

Washington (England).

J. M. Eno, and D. C. Pollington.

Water Pollution Control, Vol 74, No 5, p 571-583, 1975. 3 fig. 8 tab. 10 ref.

Descriptors: \*Operation and maintenance, Descriptors: "Operation and maintenance, "Treatment facilities, Sewage disposal, "Sewage treatment, Storm water, Flowmeters, Suspended solids, "Waste water treatment, Waste water disposal, Sludge treatment, Sludge disposal, Sedi-mentation, Detritus, Pumping, Domestic wastes, Industrial wastes, Metals, Cost analysis. Identifiers: New Town of Washington(Great Britain), River Wear(Great Britain), Detritor, Comminutor Colliery

Comminutor, Colliery.

The New Town of Washington (Great Britain) was designated in 1964. The development, design and operation of the sewage treatment works is discussed. Prior to the planning of the new town, sewage, mostly domestic but some industrial, was dumped virtually untreated into the River Wear. The new Northumbarian River Authority imposed treatment standards that were compatible with light industry. Wide variations in the flow rates along with the presence of high suspended solid concentrations from a coal washing plant caused initial problems. During Stage I development, two communitors and one detritor were installed to control the suspended solids. Two twin side-weir storm-sewage overflows, a new flow metering system and three twin rectangular primary sedimentation tanks were added to handle the flow variations. Sewage sampling over the years in-dicates that the strength of the sewage is decreasing, mainly because of the increase in modern housing. A temporary pumping station was built for sludge disposal. Cost analyses were performed on various sludge disposal methods. A tanker was purchased and the sludge was temporarily transported to sea. Sea disposal through pipes was most likely to be adopted. Industrial waste waters contained grit from the colliery, cyanide, phenol, and various metals including iron, copper, chromium, nickel and zinc. Industrial effluents were controlled by the consent procedure. In Stage II development, increased population made seconda-ry treatment necessary. Two aeration units and four final settling tanks were added and the flow apparatus was automated. A central processor is used for continuous surveillance, data recording and plant control. (Pinto-FIRL)

FREEWAY STORM RUNOFF WILL BE CLARIFIED,

W76-03717

Michigan Dept. of State Highways, and Transportation, Lansing. M. Rothstein

Public Works, Vol 106, No 11, p 65, November,

Descriptors: \*Storm runoff, \*Highway effects, \*Lakes, Water pollution sources, Oil wastes, \*Waste water treatment, Separation techniques, Pumps, Michigan.

A special outlet extending 2000 feet into Lake St. Clair, Michigan, has been installed to collect surface drainage from an interstate highway. Before entering the underwater discharge line, silt, debris and oil wastes washed from the highway will be prevented from polluting the lake by passing into a 778.5-ft long settling and skimming chamber. Storm water runoff from the highway will be delivered by a 102-inch runnel sewer to a pumphouse adjacent to the stream end of the chamber. Discharge from the settling and skimming chamber is by a 14-ft diameter drop that connected to the tunnel sewer. The chamber, ented from polluting the lake by passi shaft connected to the tunnel sewer. The chamber, 42 ft long and 12 ft deep, has sluice gates on the discharge end of each side to provide additional flow control. The downstream end of each chamber has a weir to maintain a constant water laster before the control of the cont level. Floating oil retainers and a baffle retain surface oils. these are removed by a floating oil skimmer at a rate of 480 gal/hr. Normally, downstream gates will be closed and flow into the chamber will be at a low rate to allow oils to rise to the surface and become trapped by the baffle. In the event of a major oil spill at low flow, the pumphouse would shut off and oil would be pumped into the sluiceway for removal by pump trucks. If an oil spill occurred during a storm, oil would be trapped in the large chamber of the downstream end and be removed by two skimmer units into a 200-gallon tank. (Kramer-FIRL) W76-03718

THICKENING OF COAGULANT AIDED PRI-MARY WASTEWATER SLUDGES, J. W. Oliver.

Available from University Microfilms Inc., Ann Arbor, Mich. 48106. Order No. 75-21, 475. PhD Thesis, 1975, 356 p.

Descriptors: \*Waste water treatment, \*Sludge Sedimentation, Sludge disposed Research treatment. techniques Coagulation, Research. Identifiers: \*Gravity thickening, Solids flux analy-

Research was conducted on the design of gravity thickeners for coagulant aided primary sludges. Laboratory tests were performed using solids flux analysis and the Yoshioka graphical solution. Results indicated that an impact on the settling velocity and limiting solids flux were produced by column diameter, initial sludge height, initial solids concentration, slow stirring, aging and shearing, and sludge type. The major laboratory system variables were evaluated separately for each sludge type. Settling velocity data for all sludges followed a power function relationship, with a bottom filling procedure being the most effective is assuring a completely uniform initial solids concentration. All the coagulant aided primary sludges were determined to be compressible and non-ideal nature. It was recommended that full-scale thickener operation tests be conducted for com-parison with these laboratory results. (Kramer-W76-03720

CURRENT TRENDS IN PACKAGED WASTE-WATER TREATMENT FACILITIES, PART III. New Jersey Inst. of Tech. Trenton. Dept. of Civil and Environmental Engineering. R. Dresnack, and W. Miller.

Water and Sewage Works, Vol 122, No 10, p 98-101, October, 1975. 4 fig.

Descriptors: \*Activated carbon. \*Coagulation. \*Biological treatment, \*Waste water treatment, \*Sewage treatment, Treatment facilities, Operation, Maintenance, Design criteria, Biochemical oxygen demand, Suspended solids, Monitoring, Equipment.

Identifiers: Physico-chemical treatment, Chemical-biological treatment, Chemical treatment, Package plants.

As the third part of a series on packaged waste water treatment plants, this paper discussed process variations, performance data, and selection criteria. A unit was designed by Zurn Industries, Incorporated, for physico-chemical treat-ment using activated carbon and alum coagulation combined with chlorination and sand filtration. A flow diagram and layout plan for this process was illustrated. A flow diagram for a chemical-biological treatment plant designed by Environment/One Corporation was also provided. The second plant operated on a modified batch process whereby waste water is accumulated and continuously aerated until a complete tank has been accumulated. The fresh water is then diverted out of the raactor vessel and the vessel becomes a sedimen-tation basin where organic polymer is added. Rapid sedimentation occurs as a product of biological stabilization, chemical flocculation, and quiescent settling conditions. Additionally, operational problems in package plants were outlined. These included mud (due to storm flow), noise from blowers or motors, scum formation when too much air is being used, and odors. Performance data were presented for a Tex-A-Robic extended aeration package treatment plant in Watchung, New Jersey, including yearly fluctuation of BOD and suspended solids. It was found that although effluent quality was better than it had formerly been with septic tanks, better operation, maintenance, and monitoring of equipment and flow would produce a cleaner effluent. (See also W76-00272) (Kramer-FIRL) W76-03788

HEAVY METAL RELEASE BY CHLORINE OX-IDATION OF SLUDGES.

Van Note-Harvey Associates, Blacksburg, Va. J. W. Oliver, W. C. Kreye, and P. H. King. Journal Water Pollution Control Federation, Vol 47, No 10, p 2490-2497, October, 1975. 5 fig, 6 tab,

Descriptors: \*Sludge treatment, \*Municipal wastes, \*Industrail wastes, \*Heavy metals, \*Water reuse, Recycling, Treatment facilities, \*Water reuse, Recycling, Treatment facilities, \*Waste water treatment, Chlorination, Dewatering, Sludge digestion, Laboratory tests.

Identifiers: Chlorination oxidation, Sludge chlorination, Filtrates, Municipal-industrial

Chlorine oxidation of sludge from the treatment of combined municipal-industrial wastes was researched. Quantitative analysis was performed on heavy metal release from various sludge in a laboratory chlorine oxidation process and in a full-scale operating unit. The chlorine oxidation process is an alternative to anaerobic digestion. Results indicated that (quantitatively) the release of heavy metals from sludge is stabilized by using the chlorine oxidation method. The optimum digestion procedure for determining the heavy metal content of sludge was HNO3-HC1 double digestion for six hours. The release of such metals from sludges (consisting of primary plus activated or trickling filter humus and anaerobic) was found to be a function of the final pH of the sludge after chlorine oxidation, the type of sludge oxidized, and the species of metals present in the sludge. Because the filtrate from chlorine oxidation is usually recycled to the influent of a waste water treatment plant, detrimental effects may result from the heavy metals. In addition, COD, pH, chlorides, phosphorus, and chloramines found in the filtrate should be evaluated. It was suggested that pH adjustment should be practiced following chlorine oxidation and before the final dewatering in order that the filtrate returned to the treatment plant be less harmful to the facility. (Kramer-FIRL) W76-03789

V-NOTCH WEIR AIDS IN METERING TREATED EFFLUENTS, Clontz (J.R.) Associates, Tampa, Fla For primary bibliographic entry see Field 5A.

THE DISPERSED FLOW MODEL FOR BIOLOGICAL REACTOR AS APPLIED TO THE ACTIVATED SLUDGE PROCESS. Syracuse Univ., N.Y. Dept. of Chemical Engineering and Materials Science.

R. M. Turian, G. E. Fox, and P. A. Rice. The Canadian Journal of Chemical Engineering, Vol 53, No 4, p 431-437, August, 1975. 9 fig, 3 tab, 13 ref.

Descriptors: \*Activated sludge, \*Kinetics, \*Model studies, Mathematical models, \*Waste water treatment, Mixing, Biomass, Growth rates, Organic loading, Sewage treatment, Biochemical oxygen demand. Identifiers: Shock loads.

The axial dispersion model of Levenspiel is the best available model for describing mixing in a conventional activated sludge aeration basin. Combiningthis mixing model with a suitable expression for waste removal kinetics provides a description of the activated sludge process. The equations presented are applied to the analysis of the activated sludge process. BOD and biomass profiles are calculated for activated sludge reactors using Monod kinetics and assuming that growth parameters are uniform over the length of the tank. Plug flow or complete mixing are con-sidered as limiting cases of the overall model. Approximate perturbation solutions are calculated for these two limiting situations. The perturbation

solutions are compared with the solutions of numerically integrated equations over a range of parameters corresponding to real activated sludge systems. Smaller values of the dispersion number result in larger BOD removals. As the dispersion number decreases, the steepness of the increase in the biomass concentration increases, shape of concentration vs. reactor length profiles is increasingly dependent on the saturation constant. Dispersion number values greater than one are desirable to prevent upsets in activated sludge tanks resulting from shock loading. Activated sludge operation is more stable at higher values of the dispersion number because the tank conditions are more uniform and less affected by changes in the feed stream (Orr-FIRI.)

APPLICATION OF KINETIC MODELS TO THE CONTROL OF ACTIVATED SLUDGE

T. W. Keyes, and T. Asano.

Journal of Water Pollution Control Federation. Vol 47, No 11, p 2574-2585, November, 1975. 9 fig, 6 tab. 13 ref.

Descriptors: \*Activated sludge, \*Kinetics, \*Model studies. \*Waste water treatment, Treatment facilities, Control systems, Mathematical models, Biomass, Biochemical oxygen demand, Suspended solids, Flow rates, Sewage treatment, Montana.

Identifiers: Sludge age, Bozeman(Mont).

Mathematical models are convenient to use to describe the kinetics of activated sludge processes. Applicable kinetic models are presented which were used for operational modifications of the City of Bozeman, Montana, Waste-water Treatment Plant. The study determined the average waste water loadings and activated sludge plant performance from August through December, 1973, and the feasibility of increasing the waste water flow rate to the activated sludge system without degrading the final clarifier ef-fluent quality. Process modifications, based on the analysis, were implemented in June and July of 1974. The mean cell residence time is an important factor in the control of activated sludge process performance. A higher BOD5 removal was achieved by reducing cell residence time, thereby achieved by reducing cell residence time, thereby producing a younger, more active biomass in the aerator. The change in the sludge age must be balanced out with the secondary clarifier performance and the optimum combiation of BOD5 removal in the aerator and the clarifier sludge settleability. Based on the kinetic models employed, it was decided that the waste water flow rate to the activated sludge system should be increased from 1.1 to 2.1 mgd. The increased loadings had a beneficial effect on the effluent TSS concentrations. The reduction in TSS increased form 65% to 75%. The kinetic models permitted the institution of near full capacity conditions at the Bozeman facility. (Orr-FIRL) W76-03794

PROCESS CONTROL AS AN AID TO POLLU-TION CONTROL,

For primary bibliographic entry see Field 5G. W76-03795

W76-03797

DYNAMICS OF NITRIFICATION IN THE AC-TIVATED SLUDGE PROCESS, Tennessee Eastman Co., Kingsport. For primary bibliographic entry see Field 5B.

MULTI-PROCESS RIOLOGICAL TREATMENT

MODEL, CH2M Hill, Bellevue, Wash. D. R. Christensen, and P. L. McCarthy. Journal Water Pollution Control Federation, Vol 47, No 11, p 2652-2664, November, 1974. 2 fig, 7 tab. 9 ref.

Descriptors: \*Biological treatment, \*Mathematical models, \*Computers, \*Kinetics, Activated sludge, Aeration, Nitrification, Dentrification, Aerobic digestion, Anaerobic digestion, Waste water treatment, Mixing, Energy.
Identifiers: \*BIOTREAT, Stoichiometry, Aerated

lagoons. Sulfate reduction

computerized biological treatment model, BIOTREAT, in Fortran IV language, uses stoichiometry, thermodynamics, and kinetics for the study of a number of biological processes in suspended growth in a complete mix reactor. It is primarily concerned with activated sludge, aerated lagoons, nitrification, dentrification, sulfate reduction, anaerobic or aerobic digestion, and anaerobic ponds. Sludge yields, oxygen requirements, nutrient needs, and methane production, which usually have to be input with coefficients, are determined by BIOTREAT from the mass and energy relationships of the compounds involved in biochemical reactions of the treatment process. The program utilizes a catalog of halfreactions that can be input when a run is made; this allows the modelling of a number of processes. In this manner, the engineer only has to be familiar with one model in order to study a wide variety of treatment applications. A special halfreaction and subroutine are available for modelling with unique organic wastes since all sources of waste cannot be included in the catalog. Furthermore, increasing quantities of information about a process can be input, and more accurate output results will be obtained. (Waltner-FIRL)

MATHEMATICAL PHOSPHORUS MOVEMENT IN SOILS, Michigan State Univ., East Lansing. Dept. of Chemical Engineering For primary bibliographic entry see Field 5B. W76-03802

CHEMICAL ENGINEERING AND THE EN-VIRONMENT--A REVIEW.

Australian Chemical Engineering, Vol 16, No 6, p 3, 5, 6, June, 1975. 8 ref.

\*Water quality Descriptors: control. "Environmental effects, "Sewage treatment, "Air pollution, "Chemical engineering, Recycling, Equipment, Flow meters, Industrial wastes, Oil spills, Legislation, "Reviews. Identifiers: Australia.

A review is presented of air purification, water treatment, effluent disposal and recycling, and sewage treatment, as they pertain to chemical engineering in Australia. An increased use of smoke emission monitoring systems and air pollution monitoring equipment has been noted. Water pollution control standards are outlined in the Clean Waters Act of 1970, which sets limits that should be achievable by filtration, separation, sedimentation, and chemical treatment methods. Oil contamination is discussed as a common form of water pollution; monitoring devices and methods of cleaning oil spills are detailed. Basic principles of industrial effluent treatment and associated types of equipment are outlined. Sewage treatment is generally accomplished by biological treatment. Most sewage treatment and disposal equipment is now supplied as a complete plant, and many sewage treatment facilities are automatic, employing Vee-notch, magnetic flow meters, venturi tubes, differential flow meters, various measurement equipment, and special pumps for transferring sludges and slurries. It was concluded that chemical engineering will play an important role in identifying and solving environmental problems in Australia and in maintaining environmental quality (Kramer-FIRI.) W76-03805

#### **Group 5D—Waste Treatment Processes**

EPIDEMIOLOGY OF SALMONELLAE AND FERTILIZING OF GRASSLAND WITH SLUDGE (SALMONELLENEPIDEMIOLOGIE UND GRUENLANDDUENGUNG MIT KLAERSCHLAMM).

For primary bibliographic entry see Field 5C.

SOCIAL AND ECONOMIC DEVELOPMENT CRITERIA IN POTABLE WATER AND SEWERAGE SYSTEMS (CRITERIOS SOCIALES Y ECONOMICOS DE DESSARROLLO EN LOS SISTEMAS DE AGUA POTABLE Y ALCAN-TARILLADO),
For primary bibliographic entry see Field 5F.

W76-03808

TRUMMER TURE SCREW PUMP. For primary bibliographic entry see Field 8C.

INDUSTRIAL AND MUNICIPAL SLUDGE DE-WATERING, THE BOEING 'BEST' SYSTEM, Boeing Aerospace Co., Seattle, Wash. Environmental Protection Systems.
R. K. Ames, H. H. Peters, and R. L. Olson. In: Proceedings of the 29th Industrial Waste Conference, May 7-9, 1974, Lafayette, Indiana, Purdue University, p 207-212, 6 fig.

Descriptors: \*Dewatering, \*Municipal wastes, \*Industrial wastes, \*Sludge treatment, \*Waste "Industrial wastes, "Sludge treatment, "Waste water treatment, Sludge, Cost comparison, Effluents, Oil, Solubility, Lime.
Identifiers: Boeing Extractive Sludge Treatment(BEST), Aliphatic amine solvents, Reverse solubility, Filter cake.

The Boeing Extractive Sludge Treatment (BEST) process is discussed. Emphasis in the study is placed on industrial sludge. This process uses the unique properties of a family of aliphatic amine solvents to remove water and oil from both organic and inorganic sludges. The products are a dry sludge, clear water effluent and oil that can be used as an energy source or a commercial byproduct. Other advantages included economical operation and lack of environmental impact. The unusual property of this class of solvents is a reverse solubility with temperature characteristic. When these solvents are added to a sludge, and the system is cooled, it becomes a two phase system, with solid particles dissolved in a solution of water, oil, fats and solvent. Solids are removed mechanically. A small temperature increase separates the water from the solvent, oil and fat solution, and the latter is separated by distillation. Theoretical cost comparison of this process with brute force drying of the water shows the BEST process is more economical. The process works well on both municipal and industrial sludges. The process used on a high lime sludge produced 27.2% filter cake and a clear sterile effluent. Used on an oily waste, there was left 35% dried solids and a colorless clear effluent. Further separation gave a water effluent containing 0.1% solvent and no oil. Most of the oil was recovered. The dry filter cake and the effluents were analyzed for their quality. The system was run and discharges analyzed over a period of time to determine optimum operational parameters and to refine system operation economics. (Pinto-FIRL) W76-03816

PUMPS: APPLICATION AND DESIGN BASICS, PART II, Clarkson Coll. of Technology, Potsdam, N. Y.

Dept. of Chemical Engineering. For primary bibliographic entry see Field 8C.

STUDIES ON PREVENTION OF WATER POL-LUTION. IV. EFFECT OF SYNTHETIC DETERGENTS ON WASTE PURIFICATION WITH AC-GENIS ON WASIE PORINICATION WITH ACTIVATED SLUDGE PROCESS (SUISHITSU ODAKU BOSHI NI KANSURU KENKYU (DAI PO). HAISUI NO KASSEIODEI SHORI NI OKERU GOSEI SENZAI NO EIKYO NI

TSUITE),
Tohoku Coll. of Pharmacy, Sendai (Japan).
For primary bibliographic entry see Field 5C.

POLYMER CONDITIONING OF CHEMICAL SLUDGES

Missouri Univ., Columbia, Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E. W76-03822

ANAEROBIC DIGESTION OF SLUDGE, PART

Pirnie (Malcolm), Inc., Paramus, N.J. A. F. Weland, and P. N. Cheremisinoff. Water and Sewage Works, Vol 122, No 10, p 80-83, October, 1975. 5 fig.

Descriptors: \*Sludge treatment, \*Anaerobic digestion, Anaerobic conditions, Sludge disposal, \*Waste water treatment, Landfill, Methane.

Anaerobic digestion of sludge was discussed. It is impractical to use digestors which double the capital cost and lower the Btu value of sludge if incineration is to be the ultimate disposal method. However, the digestion will continue to be used in small treatment plants and in large cities where land and ocean dumping are available and economical. One of the major assets involved in using digestion is that it takes raw sludge containing noxious materials and produces a basically ert and useful landfill material. Other advantages of digestion are methane production, high organic loading, no oxygen transfer-aerators, reduction of volatiles, no additional nutrients, and low solids production. Disadvantages, aside from main-tenance costs, include supernatant treatment, operation difficulties, erratic sludge volume reduction, close process control, need for backup systems, build up of fines in treatment plant, critical growth system, toxic oxygen, need for external heating, expensive tankage and dewatering. Anaerobic digestion consists of two stages. During the first stage, simple organic structures are formed through complex reactions involving anaerobic acid forming bacteria which metabolize solid and dissolved complex matter such as proteins, carbohydrates, fats, and other organic materials. The structures are metabolized through a number of intermediates to produce simple volatile organic acids and important buffering materials. During the second stage, simple volatile acids are metabolized by methane producing bacteria; methane and carbon dioxide are the main end products. (Waltner-FIRL) W76-03827

ENVIRONMENTAL EFFECTS OF ADVANCED WASTEWATER TREATMENT AT SOUTH LAKE TAHOE,

California Regional Water Quality Control Board, South Lake Tahoe. Lahonton Region. Journal Water Pollution Control Federation, Vol 47, No 11, p 2694-2701, November, 1975. 2 fig, 5

Descriptors: \*Waste water treatment, \*Treatment facilities, \*Tertiary treatment, \*Environmental effects, Energy, Pollution abatement, California. Identifiers: Secondary pollution.

The results of an assessment of direct and indirect energy requirements and environmental impacts associated with the operation of the full-scale advanced waste water treatment plant at South Lake Tahoe, California, are reviewed. Although the installation effectively removes organic materials and nutrients from domestic waste water, it requires large amounts of energy and treatment chemicals. A number of contaminants are released on land and in the air. It is impossible to tell, despite quantitative data on energy and materials consumption and on contaminant emissions, if advanced waste treatment processes significantly reduce the net level of degradation in the total environment. A common denominator should be found with which different types and quantities of pollutants released in the environment could be quantitatively compared. (Waltner-FIRL) W76-03828

NEERI ACCEPTS CHALLENGE TO REDUCE POLLUTION. Indian Chemical Journal, Vol 10, No 1, p 13, July,

Descriptors: \*Water pollution control, \*Foreign research, \*Waste water treatment, Sewage treatment, Industrial wastes, Oxidation lagoons, Aeration, Fertilizers, Irrigation, Legislation.

The National Environmental Engineering Research Institute (NEERI), Nagpur, India, has devised methods of treating industrial wastes and sewage which are inexpensive and unconventional but effective. The methods reduce capital costs up to 80% and reduce operating costs up to 90%. The methods take advantage of the sunshine and warm climate of India which favor the treatment of wastes in oxidation or stabilization ponds. Wastes are stored in large well-defined shallow ponds for several days while algae and bacteria digest the organic wastes. The waste water is then suitable for irrigation. Oxidation ditches with extended mechanical aeration are recommended for midsized towns because they require less surface area than oxidation ponds. Sewage treatment for these than oxidation points. Sewage treatment for intestitions towns can pay for itself by providing irrigation water that contains all the essential nutrients (nitrogen, phosphorus, and potassium) for use as fertilizer. The reuse of sewage effluents for industrial purposes is also being instigated in large cities such as Bombay. The Central Board was created under the Prevention and Control of Pollution Act which was enacted in 1974. This board will promote the cleanliness of streams and wells and provide technical assistance and guidance to State Boards and sponsor investigaions and research relating to problems of water pollution. Legislation is being studied which will tax the major industrial contributors to water pollution. (Orr-FIRL) W76-03831

RESEARCH NEEDS IN THE CONTEXT OF OUR GOAL TO RESTORE AND MAINTAIN THE CHEMICAL, PHYSICAL, AND BIOLOGI-CAL INTEGRITY OF THE NATION'S WATERS, National Science Foundation, Washington, D.C. Div. of Advanced Environmental Research and Technology.
For primary bibliographic entry see Field 5G.
W76-03832

ZERO DISCHARGE OF INDUSTRIAL WASTE-WATERS,

Environmental Protection Agency, Washington, D.C. Office of Research and Development. For primary bibliographic entry see Field 5G. W76-03834

WASTE WATER RENOVATION AND REUSE: STATE OF THE ART, Clemson Univ., S. C. Dept. of Environmental

Systems Engineering. T. M. Keinath.

In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 49-63. 3 tab, 8 ref.

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

Descriptors: \*Waste water treatment, \*Municipal wastes, \*Water reuse, Public health, Treatment facilities, Coagulation, Adsorption, Filtration, Ion exchange, Nitrogen, Reverse osmosis, Reclaimed water, Reviews.

Identifiers: Public opinion.

The state-of-the-art of the renovation of municipal waste water for the reuse of such waters as a via-ble water resource is discussed. The four basic areas that this discussion covers are: the public's attitude toward the reuse of renovated municipal waste water; the specific health considerations; the primary reclamation processes; and, the experiences of a reclamation facility in renovating waste waters for reuse. A public attitude survey was sponsored by the University of California at Berkeley and the California State Department of Public Health to determine how the public would respond to the concept of reusing municipal waste waters. The consensus was that proposals to im-plement the reuse of renovated municipal waste waters would not meet with serious opposition as long as the proposals are properly introduced. The health aspects of reusing municipal waste water include bacteriology, virology, algology, parisitology, and toxicology. The treatment processes that are capable of high degree of treatment required for reuse purposes are those that were developed under the supervision of the Advanced Waste Treatment Program of the Environmental Protec-tion Agency. These treatment methods include coagulation, adsorption, filtration, ion exchange, nitrogen removal, and reverse oxmo-sis/ultrafiltration. Operation of the South Lake Tahoe, California, reclamation facility is discussed. (Orr-FIRL)

WASTES RECYCLING BEFORE FINAL WASTE

DISPOSAL, General Electric Co., Schenectady, N.Y. Environmental Protection Operation.

J. M. Phillips.
In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 82-86.

Descriptors: \*Waste water treatment, \*Recycling, \*Industrial wastes, Waste water disposal, Waste disposal, Incineration, Ultimate disposal, Planning, Water pollution, Air pollution, Solid wastes, Pollution abatement.

Wasters; Foliation adaction:
Identifiers: Waste recovery, \*Waste recycling,
Waste reclamation, Zero discharge.

Alternatives to industrial waste water treatment are discussed. Alternatives such as waste recovery and incineration are means of reaching the 1985 zero discharge goal. Within the General Electric company, waste recovery is emphasized as a daily cost saving measure and standard operation procedure. Copper is reclaimed at a rate of \$14 million dollars per year. A plant in Hendersonville, North Carolina, resmelts 200 tons of aluminum per month for internal use, and another plant in Louisville, Kentucky, converts 150,000 tons/year of steel punching into cast iron. Incineration is considered as one method of ultimate disposal, especially in situations where toxic chemicals must be disposed of. Incineration presents a trade-off situation between how much air pollution will be permitted vs. the contents of the scrubber water, and between the amount incinerated vs. the amount landfilled. When designing waste water treatment systems the following steps must be included: bring management into the picture including safety, water pollution, air pollution, noise pollution, and solid wastes; and, consider alternatives to end-of-the-pipe treatment. Some case histories of alternatives to end-of-the-pipe treatment are presented. (Orr-FIRL)

ULTIMATE DISPOSAL OF WASTEWATERS, Environmental Protection Agency, Washington, D.C. Office of Research and Monitoring. For primary bibliographic entry see Field 5E. W76-03841

SLUDGE HANDLING AND DISPOSAL-STATE OF THE ART.

Delaware Univ., Newark. Dept. of Civil Engineering. For primary bibliographic entry see Field 5E. W76-03842

SLUDGE RECYCLING: THE WINSTON-SALEM EXPERIENCE,

For primary bibliographic entry see Field 5E. W76-03843

THE EFFECT OF INCINERATION ON METALS, PESTICIDES, AND POLYCHLORINATED BIPHENYLS IN SEWAGE SLUDGE.

National Environmental Research Center, Cincinnati, Ohio. Advanced Waste Treatment Lab. J. B. Farrell, and B. V. Salotto.

In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 186-198, 2 fig, 5 tab, 6 ref.

Descriptors: \*Waste water treatment, \*Municipal wastes, \*Industrial wastes, \*Pesticides, \*Polychlorinated biphenyls, Heavy metals, \*Metals, Sludge, Incineration, Waste disposal, Mercury.

A study was conducted by the Ultimate Disposal Research Program, Advanced Waste Treatment Laboratory, at the National Environmental Research Center, Cincinnati, Ohio, to establish concentration of hazardous materials in sludge, and to determine the fate of these substances upon incineration. Sludge samples were obtained from sewage treatment plants where sludge was being incinerated in multiple-hearth in-cinerators and fluidized bed incinerators. The sludge, ash, and scrubber water were analyzed for metals, pesticides, and polychlorinated biphenyls (PCB's). There is a wide range of concentrations of pesticides and PCB's in sludge indicating that these compounds could be a minor problem in some cases and a major problem in others. There is no easy way to tell without testing whether a sludge contains a high level. Pesticides and PCB's were not found in the ash or scrubber water. It is infered that these are destroyed by incineration. The concentrations of hazardous metals are considerably higher in sludge than in soil or coal fly ash. The concentration seems to be related to the fraction of the waste which comes from industrial sources. Except for mercury, metals show no serious disproportionation into the particulate phase leaving the incinerator. Mercury is essentially totally vaporized into the stack gases. More investigation on the fate of pesticides, PCB's, and metals upon incineration is needed. (Orr-FIRL) W76-03845

LAND DISPOSAL: STATE OF THE ART, Cold Regions Research and Engineering Lab., Hanover, N.H. For primary bibliographic entry see Field 5E. W76-03849

RECYCLING ALLOWS ZERO WASTE WATER DISCHARGE,

Black, Crow, and Eidsness, Inc., Clearwater, Fla. For primary bibliographic entry see Field 5E. W76-03926

RECLAMATION OF HYPERION SECONDARY EFFLUENT BY REVERSE OSMOSIS, California Univ., Los Angeles. School of Engineering and Applied Science.

M. B. Kim-E, and J. W. McCutchan.

Available from NTIS, Springfield, Va 22161 as PB-249 260, \$5.50 in paper copy, \$2.25 in microfiche. California Water Resources Center, Desalination Report No 60, UCLA-ENG-7542 June 1975. 116 p, 11 fig, 8 tab, 60 ref.

Descriptors: \*Waste water treatment, Effluents, \*Desalination, \*Reverse osmosis, Membranes, Filters, Filtration, \*Disinfection, Cleaning, Surfactants, California, Bacteria. Identifiers: Roccal solution, Sulfur dioxide gas.

A reverse osmosis unit of 12 tubular cellulose acetate membranes was tested for its performance on the secondary effluent of Hyperion Treatment Plant. In 1974, this effluent had an average of 614 mg/l TDS and 0.6 mg/l oil and grease. In the first part of the experiment a filter of 50 micro pore size was used as the only pretreatment of the waste-water. The fluxes of the individual tubes and their total dissolved solids were measured under a 400 psig pressure at 5 gpm flow rate. Fluxes decreased rapidly (about one-third of the initial values in two weeks) due to particulates and oily substances in the influent. Chemical and bacterial analyses were run on both the influent and product water. The average desalination ratio was 8.74. Next, sulfur dioxide gas and Roccal solution were injected into the influent to determine their effectiveness as dis-infectants. More than 200 mg/l SO2 and 100 mg/l Roccal were needed to reduce the coliform count in the brine to < 0.03 mpn/ml with a 30 minute residence time. Cleaning of the membrane tubes was studied. Fluxes were readily restored to 80% of their initial values using BIZ, a non-ionic surfac-tant, or citric acid. (Snyder-Calif, Davis)

MODEL TO PREDICT THE PERFORMANCE OF FEEDLOT CONTROL FACILITIES AT SPECIFIC OREGON LOCATIONS.

Oregon State Univ., Corvallis. Dept. of Agricul-

tural Engineering. R. B. Wensink, and J. R. Miner.

Presented at the 1975 Annual Meeting, American Society of Agricultural Engineers, University of California, Davis, June 22-25, 1975, 23 p. 1 fig, 10 tab, 7 ref.

Descriptors: \*Farm wastes, \*Performance, \*Feed lots, \*Oregon, Waste storage, Design, Model studies.

Identifiers: Retention basins

The objectives of this study were to develop a cattle feedlot runoff control model, and to utilize the model to determine relationships between historical climatological data and per-formance of various runoff retention system designs. The sufficient design method was used to determine the minimum storage volume required to prevent illegal discharges as defined by the DPW Effluent Guidelines. In some locations the use of high capacity irrigation equipment allowed reduction of the storage capacity by over 45 percent when a larger pumping system was specified. In other locations, due to the precipitation pattern, no benefit was obtained by the use of pumping equipment with capacity in excess of 0.10 (10 year-24 house storms). Utilization of the sufficient design technique requires the compilation of weather data for a unique climatological region under consideration. The model is relatively inexpensive to operate and a complete climatological region can be analyzed for less than \$20, once the regions climatic data are computerized. (Cameron-East Central) W76-03971

A SURVEY OF EFFECTS OF ANIMAL WASTES ON STREAM POLLUTION FROM SELECTED DAIRY FARMS.

DAIRY FARMS, Clemson Univ., S.C. Dept. of Dairy Science. For primary bibliographic entry see Field 5B. W76-03974

#### **Group 5D—Waste Treatment Processes**

CHINO VALLEY SHAKER, For primary bibliographic entry see Field 5E. W76-03976

SOLID WASTE HANDLING, Pennsylvania State Univ., University Park. For primary bibliographic entry see Field 5E. W76-03977

REVIEW PAPER: ANIMAL WASTES MANAGE-MENT AND CHARACTERIZATION, Utah State Univ., Logan. Div. of Environmental

Engineering.
For primary bibliographic entry see Field 5B.

RACEWAYS: EXOTIC SPECIES MOST AF-FECTED BY PROPOSED E.P.A. DISCHARGE

Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management. For primary bibliographic entry see Field 5G. W76-03980

KEEPING THE FEEDER IN BUSINESS. Soil Conservation Service, Lincoln, Nebr For primary bibliographic entry see Field 5G. W76-03983

MY WASTE-HANDLING SYSTEM FOR BEEF. For primary bibliographic entry see Field 5G. W76-03986

AGRONOMIC CONSIDERATIONS OF ANIMAL

WASTE DISPOSAL,
Iowa State Univ., Ames. Cooperative Extension For primary bibliographic entry see Field 5B. W76-03987

SUMMARY OF KANSAS' EXPERIENCE WITH

LIQUID WASTE SPREADING, Kansas State Univ., Manhattan. Dept. of Agricultural Engineering; and Kansas State Univ., Manhattan. Dept. of Agronomy. For primary bibliographic entry see Field 5E. W76-03988

OUTDOOR, UNPAVED FEEDLOT MANAGE-MENT

Nebraska Univ., Lincoln. Agricultural Experiment For primary bibliographic entry see Field 5E. W76-03989

LIVESTOCK WASTE MANAGEMENT IN A QUALITY ENVIRONMENT, Illinois Univ. at Urbana-Champaign. Cooperative

Extension Service. D G Jedele

Presented at Proceedings of 1973 Livestock Waste Management Conference, Champaign, Illinois, March 7-8, 1973, Circular 1074, p 1-15, 8 fig, 1 tab.

Descriptors: \*Farm wastes, \*Treatment facilities, \*Feed lots, \*Livestock, Agricultural runoff, Liquid wastes, Lagoons, Confinement pens, Solid wastes, \*Waste treatment. Identifiers: \*Waste management, Hauling, Gutter flushing, Oxidation ditch, Odor control, Dead animal disposal.

This circular was prepared to assist the livestock producer in assessing the pollution potential of livestock operations and to provide a systematic approach to resolving problems. The circular does not incorporate extensive technical data buildings manure collection and handling facilities, or equipment. It does delineate the parts of a waste

management system, listing alternatives that may be used. Systems for reducing water pollution are described including: (1) Feedlot runoff control for described including: (1) Feediot runoft control for unrestricted space, (2) Feediot runoft control for restricted space, (3) Liquid manure system — hauling, (4) Liquid manure system — hauling and lagooning, (6) Liquid manure system — hauling and lagooning, (6) Gutter flushing in a confinement building, (7) Oxfortion of the confinement building, (8) (4) idation ditch in a confinement building and (8) Solid and liquid system for dairy facilities. Suggestions are given for reducing odor. Options for dead animal disposal are discussed. (Merryman-East Central) W76-03991

APPLICATION OF REVERSE OSMOSIS IN WATER CONSERVATION AND TREATMENT IN THE MOTOR INDUSTRY

Ames Crosta Mills and Co., Heywood (England). B. Leightell.

Chemistry and Industry, No. 11, p 437-440, June 1, 1974 2 fig

Descriptors: \*Waste water treatment. \*Industrial wastes, \*Reverse osmosis, \*Membrane processes, Water reuse, Water conservation.

Identifiers: Automobile industry, Metal finishing

Major pollution problems in the automobile industry result from the large quantities of water used. The processes which use water in metal finishing and machining include: aqueous coolants used in metal cutting operations; electrophoretic painting; metal pickling; and, electroplating. Electroplating produces effluents containing various toxic components such as cyanide, chromium, nickel, zinc, and copper. Both economic and environmental benefits will result if the metals and chemicals can be retrieved and the volume to be disposed can be reduced by the removal of water. One such technology is reverse osmosis, which has been successful in the United States. The benefits as well as the limitations of reverse osmosis are discussed. (Kramer-FIRL)

FLUIDIZED-BED FILTER IN ION-EXCHANGER UNITS (DAS SCHWEBEBETT-FILTER BEI IONENAUSTAUSCHER-AN-

A. Berninger. Galvanotechnik, Vol 65, No 4, p 311-318, 1974. 13

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Ion exchange, Resins, Ions, Metals. Identifiers: Floating-bed ion exchangers, \*Metal finishing wastes

Floating-bed ion exchangers are used for water preparation, industrial processes, and industrial waste water purification. The ion exchange resin in floating-bed exchangers is placed between two nozzle plates, and the waste water to be purified is passed through it from bottom to top, with regeneration performed from top to bottom. Part of the ion exchange resin is floated by the effluent streaming upward, while the quantity of the suspended resin is determined by such factors as the flow velocity, the viscosity of the effluent, and the properties of the resin. Floating-bed ion exchangers excel by their low pressure loss, reduced reagent expenditure for regeneration, and low rate of ion slip. Floating-bed ion exchangers are regenerated with 4-8% hydrochloric acid and 2-4% sodium hydroxide. Such ion exchangers can be connected in parallel, and can be regenerated automatically. They are suitable for the preparation of desalted and high-purity water used for industrial processes and for the elimination and recovery of chromic acid from electroplating waste waters. They also have use in the selective removal of metals, especially of precious metals including mercury, and in the purification of electroplating effluents. (Takacs-FIRL) DESIGN AND MODE OF OPERATION OF SYNTHETIC ORGANIC FLOCCULANTS AND SYNTHETIC ORGANIC FLOCCULANTS AND THEIR USE IN SOLID/LIQUID SEPARATION IN THE CHEMICAL INDUSTRY AND IN EN-VIRONMENTAL PROTECTION (AUFBAU UND HIRE ANWENDUNG BEI FEST/FLUSSIG-TRENNUNGEN IN DER CHEMISCHEN UND IM UNWELTSCHUTZ),

Chemiker-Zeitung, Vol 98, No 6, p 222-227, 1974.

Descriptors: \*Flocculation, \*Polymers, Chemical industry, \*Waste water treatment, \*Industrial wastes, \*Chemical wastes, Dewatering, Centrifugation. Identifiers: Acrylamide.

The structure, mode of operation and the uses of non-ionogenic, anionactive and cationactive or-ganic synthetic flocculants are described. Such flocculants are most often based on acrylamide. Non-ionogenic flocculants can be in the form of polyacrylamide; anionactive flocculants are usually polymers with alkali or ammonium salts of acrylic adid; and cationactive products can be modifications of polyethyleneimine, polycarbamates, and acrylamide copolymers. Such flocculants act by direct binding or binding through ac-tivation bridges or hydrogen bridges of colloids and suspended matter. The dosage is usually lower than 0.1 weight percent. Synthetic flocculants are used in the chemical industry for the purification of phosphoric acid obtained by treating phosphates with sulfuric acid by means of a high-molecular non-ionogenic floculant. Uses include note that ment of tap water by means of anionactive polymers, the clarification of black liquor in titanium plants by means of high-molecular cationactive products, and the dehardening of brine in soda production according to the Solvay process. Floc-culant polymers are also used for the removal of hydroxides and carbonates from waste water as obtained following neutralization. Strongly ca-tionactive products are used for sewage sludge treatment to facilitate settling and dehydration by means of filter presses and centrifuges. (Takacs-FIRL) W76-03994

BIOLOGICAL WASTE WATER PURIFICATION IN A LARGE LACQUER AND PAINT MANU-FACTURING PLANT (BIOLOGISCHE ABWAS-SERREINGUNG IN EINEM GROSSBETRIEB DER LACK- UND FARBENINDUSTRIE),

E. Knappe. Farbe und Lack, Vol, 80, No 2, p 103-109, 1974.

Descriptors: \*Biological treatment, \*Chemical wastes, Chemical industry, \*Waste water treatment, \*Industrial wastes, Effluents, Aeration, Biochemical oxygen demand, Waste disposal, Treatment facilities, Sludge disposal. Identifiers: Lacquer and varnish industry wastes.

The one-stage fully biological waste water treat-The one-stage fully biological waste water treatment plant established at the Hiltrup lacquer and varnish plant of BASF is described. The daily volume of the sanitary and production effluents amounts to 2,250,000 cu m with pH values ranging from 7.8 to 13.5. The BOD level is between 400 and 600 mg/liter, and the daily BOD load amounts to 1,300 kg. The waste water is treated in a 1,300 cu m-aeration tank with a rotary aerator. Urea and phosphate are added to the waste water in the aerator to correct the nutrient balance. The sludge load ranges from 0.2 to 0.4 g BOD per gram of or-ganic dry matter per day. After an average re-sidence time of 14 to 17 hrs, the BOD value is sidence time of 14 to 17 hrs, the BOD value is reduced to 2% of the original value. The carbon dioxide formed during the biological treatment spontaneously neutralizes the lye present in the waste water. The excess sludge, dewatered in a chamber type filter press to a solid content of 40%, is suitable for both disposal of sanitary landfill and incineration. (Takacs-FIRL) INTEGRATED INDUSTRIAL WASTE WATER TREATMENT PROJECT WITH ELECTROFLOTATION AND REVERSE OSMOSIS (INTEGRALES INDUSTRIE-ABWASSERPROJEKT MIT ELEKTROFLOTATION UND UMKEHROSMOSE),

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Wasser-und Energiewirtschaft, Vol 66, No 6, p 185-195, July, 1974.

Descriptors: \*Reverse osmosis, \*Waste water treatment, \*Metals, Heavy metals, Pilot plants, Treatment facilities, \*Industrial wastes, Flocculation, Polyelectrolytes, Oil wastes. Identifiers: \*Electroflotation, Aluminum sulfate.

A combined system of electroflotation and reverse osmosis units for integrated waste water purifica-tion and industrial water preparation for SWIS-SAIR was tested on a pilot scale. The waste waters to be treated contained heavy metals, cyanides, to be treated contained heavy metals, cyanides, acids, bases, salts, chromates, detergents, oil emulsions, solvents, chelates, and emulsifiers. Following detoxification and mixing in a storage tank, the effluents are treated with aluminum sulfate for flocculation, and the pH value is adjusted. A polyelectrolyte is t then added for better flocculation, after which the neutralized waste water is subjected to electroflotation for the separation of the floccules formed in the preceding stages. The treated water with the sludge removed stages. The treated water with the sludge removed is further purified by reverse osmosis, using compact spiral modules by Gulf (ROGA module). The pact spilar into description (ROOA module). The combined electroflotation and reverse osmosis system was found suitable for this purpose, and the results obtained during the pilot tests warrant the construction of a similar waste water treatment plant. (Takacs-FIRL) W76-03997

CHROMATOGRAPHIC DETERMINATION OF CONSTITUENTS IN ETHERAL EXTRACTS FROM INDUSTRIAL WASTE WATERS (DEL CONSTITUENTI L'ESTRATTO ETEREO DI ACQUE INDUSTRIALI), For primary bibliographic entry see Field 5A. W76-03998

COMBINED TREATMENT OF DOMESTIC AND

NSSC MILL EFFLUENTS,
P. J. Farrell, L. R. Heble, and A. G. Steuhser.
Paper Trade Journal, Vol 158, No 19, p 30-31, May

Descriptors: \*Industrial wastes, \*Waste water Domestic wastes, Filtration, Biological treatment, Color, Lime, Chlorine, Biochemical oxygen de-

Identifiers: Biofilters, Extended \*Combined municipal-industrial wastes.

A study of the joint treatment of domestic waste A study of the joint treatment of domestic waste water and neutral sulfate semi-chemical (NSSC) pulp and paper mill wastes was conducted. The main purpose of the study was to determine the feasibility of a joint treatment scheme, which could provide a means for regionalization of treatment and economy of scale. A pilot plant was constructed adjacent to the Harriman Utility Board, Harriman Tennessee primary waste water treatstructed adjacent to the Harriman Utility Board, Harriman, Tennessee, primary waste water treat-ment plant as a means of evaluating a variety of hydraulic and organic loadings under controlled conditions. The most effective treatment scheme consisted of a biofilter (used as a roughing filter) and an extended aeration system. Color reduction was accomplished by massive lime and chlorine additions. Disinfection was optimum when amadditions. Distinction was optimum when ammonia was mixed with the combined wastes prior to chlorination. The BOD removal efficiency of the biofilter ranged from 3% to 45%; the BOD removal efficiency of extended aeration ranged from 24% to 98%. (See also W74-06513) (Murphy-FIDI) W76-03999

#### 5E. Ultimate Disposal Of Wastes

STOP LEACHATE PROBLEMS, Lenard Engineering, Storrs, Conn. For primary bibliographic entry see Field 5B. W76-03525

REVIEW OF AMERICAN PUBLIC WORKS AS-SOCIATION STUDY OF FACILITIES UTILIZ-ING LAND APPLICATION OF WASTEWATER, American Public Works Association, Chicago, Ill. For primary bibliographic entry see Field 5D. W76-03542

AN EXPERIMENT IN THE EUTROPHICATION OF TERRESTRIAL ECOSYSTEMS WITH SEWAGE: EVIDENCE OF NITRIFICATION IN A LATE SUCCESSIONAL FOREST, Brookhaven National Lab., Upton, N.Y. For primary bibliographic entry see Field 5C. W76-03555

IRRIGATION WITH WASTEWATER AT BAKERSFIELD, CALIFORNIA, Metcalf and Eddy, Inc., Palo Alto, Calif. For primary bibliographic entry see Field 3C. W76-03556

RECYCLING FOR A PURPOSE -- BUT FOR WHAT PURPOSE. A SOCIOLOGIST'S VIEW, Central State Univ., Edmond, Okla. Dept. of Sociology. For primary bibliographic entry see Field 6B. W76-03564

ENVIRONMENTAL SURVEYS OF OPEN-OCEAN DREDGE MATERIAL DISPOSAL DISPOSAL SITES.

Naval Undersea Center, San Diego, Calif. For primary bibliographic entry see Field 5B. W76-03644

FLUIDIZED BED FURNACE HAVING COARSE PARTICLE DISCHARGING DEVICE, Rheinstalh A.G., Dortmund (West Germany). E. Albrecht, W. Oepke, and H. Wulfmeier. United States Patent 3,910,208. Issued October 7, 1975. Official Gazette of the United States Patent Office, Vol 939, No 1, p 133-134, October, 1975. 1

Descriptors: \*Patents, \*Incineration, \*Sludge treatment, \*Sludge disposal, Waste water treatment, Equipment.
Identifiers: \*Fluidized bed furnace.

A patent was granted for a fluidized bed furance for dehydrated sludge. The equipment consists of a furnace housing on which the bed is supported. Combustion air is directed upward through the bottom of this housing to reduce the sludge to fine ash. The ash passes out of the furnace with part of the combustion air. Coarse particles are also generated. The equipment is detailed for admitting the sludge material to the combustion chamber. the studge material to the combustion chamber. Connected to the fluidized bed furnace is a discharge passage. This passage has a rotatable drum portion with an interior wall; a screw thread extends at the proper angle so that the spacing between successive thread windings is large enough for the largest size particles expected to be formed in the fluidized bed to pass through. A cen-tral passage is also located between the threads to permit the passing of smaller sized particles. (Kramer-FIRL) W76-03661

WASTE SLUDGE TREATMENT WITH PRES-SURE FILTRATION,
Passavant Corp., Birmingham, Ala.
For primary bibliographic entry see Field 5D.

W76-03676

DRY SPREADER SOLVES SEWAGE TREAT-MENT PLANT PROBLEMS.
Publis Works, Vol 122, No 11, p 55, November,

Descriptors: \*Sludge treatment, \*Sludge disposal, \*Waste disposal, \*Waste water treatment, Sewage sludge, Sewage treatment, Treatment facilities, Equipment, Dewatering, Activated sludge, Municipal wastes, Indiana.
Identifiers: \*Dry sludge spreader, Land applica-

A dry sludge spreader has helped in minimizing sewage treatment plant problems at the Blucher Poole Treatment Plant in Blooington, Indiana Sludge handling during bad weather presented a real difficulty, particularly in winter months. A Big Wheels dry sludge unit was acquired by the plant and has made a significant difference in the amount of sludge that can be hauled away. From 1974 to 1975, the monthly number of dry pounds of solids to be removed from the plant increased from 5600 to 300,000. The treatment facility uses a complete mix modification of the activated sludge process and serves a population of 15,000 to 20,000. The sludge is basically domestic sewage sludge, with very little industrial waste and a low metals content. Although the sludge was highly desirable for area farmers, they would not accept studge coming from dump trucks unless the ground was frozen or dry. Now with the new spreader as a delivery method, sludge may easily be received from a belt loader and spread on cornfields and pastureland during all-weather conditions (Verger FIFIL) tions. (Kramer-FIRL) W76-03677

FROM LAGOONING TO FARMLAND APPLICATION: THE NEXT STEP IN LIME SLUDGE

DISPOSAL, Northern Illinois Water Corp., Champaign. For primary bibliographic entry see Field 5D. W76-03678

INFLUENCE OF TREATED MUNICIPAL WASTE WATER ON GROWTH, FIBER, ACID-SOLUBLE NUCLEOTIDES, PROTEIN, AND AMINO ACID CONTENT IN WHEAT GRAIN, Arizona Univ., Tucson. Dept. of Agronomy and Plant Genetics.

A. D. Day, F. A. Taher, and F. R. H. Katterman. Journal of Environmental Quality, Vol 4, No 2, p 167-169, April-June, 1975. 2 tab, 12 ref.

Descriptors: \*Waste water disposal, \*Irrigation, Crops, Crop response, Nutrients, Fertilizers, Nitrogen, Phosphorus, Potassium, Agriculture, Activated sludge, Wheat.

Experiments were performed to study the effects of treated municipal waste water and well irrigation water plus commerical inorganic fertilizer on the growth, fiber, acid-soluble nucleotides, protein, and amino acid content in whest grain (Triticum aestivum). The wheat was grown in Comoro sandy loam or Grabe silt loam. Irrigation schemes included: treatment with well water plus suggested amounts of nitrogen (112 kg/ha), phosphorus (35 kg/ha), and potassium (one kg/ha); well water plus N, P, and K from commercial sources in amount equal to those found in waste water; and, waste water from an activated sludge water; and, waste water from an activated sludge sewage plant containing 224, 73, and 140 kg/ha of N, P, and K, respectively. The average number of heads per unit area and grain yield were higher in plots that received waste water. Average days from planting to maturity, plant height, seeds per head, and seed weight were similar for all three ir-rigation schemes. Grain from the plants irrigated with waste water contained more total protein, and more alanine, histidine, isoleucine, and proline than did grain produced with well water plus sug-

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gested N, P, and K or with well water plus N, P, and K in amounts equal to waste water. Similar amounts of cystine, methionine, and threonine were obtained from grains growth under the three irrigation schemes. Treated municipal waste water is an effective source of irrigation water and plant nutrients for the production of higher quality grain from small grains grown in Comoro sandy loam soil. (Orr-FIRL) W76-03690

NITRATE NITROGEN DISTRIBUTION IN CORN LAND FOLLOWING APPLICATIONS OF DIGESTED SEWAGE SLUDGE,

Guelph Univ. (Ontario). Dept. of Land Resource Science.

For primary bibliographic entry see Field 5B. W76-03814

THE CONTROL OF POLLUTION OF GROUND-

WATER, Clyde River Purification Board, Glasgow (Scotland)

For primary bibliographic entry see Field 5G.

W76-03815

REVEGETATING BITUMINOUS STRIP-MINE SPOILS WITH MUNICIPAL WASTEWATER, PART I: GRASS AND LEGUME ESTABLISH-MENT

Pennsylvania State Univ., University Park. Dept.

B. R. Edgerton, W. E. Sopper, and L. T. Kardos. Compost Science, Vol 16, No 4, p 20-25, August, 1975. 5 tab, 9 ref.

Descriptors: \*Land use, \*Waste disposal, \*Sewage treatment effluents, \*Sewage disposal, Sludge disposal, Mining, Irrigation, Grasses, Legumes, Strip mines, Heavy metals.

Identifiers: Land application, Strip-mine spoil

The problem of revegetating acres of land which had been strip mined was investigated. This por tion of the research dealt with the determination of the effects of irrigation with municipal sewage ef-fluent and liquid digested sludge on the germination, survival and growth of a variety of grasses on a strongly acid and highly toxic spoil material. Six lysimeters were filled with strip-mine spoil materi al; the spoil was seeded with 8 grasses and 8 legumes and treated with effluents at various treatment rates. It was found that applications of municipal sewage effluent and liquid digested sludge did facilitate the establishment and growth of selected grass and legume species on this material. There was no vegetation toxicity problem from the heavy metal concentrations in the effluents or sludge. The grass species had higher yields and greater percent areal cover than the legume species. The best vegetation growth and establishment was found with the application of 2-inches of sludge plus 2-inches of effluent. Overall, the with the greatest dry matter production grasses with the greatest dry matter production had the lowest concentrations of toxic metals in the above-ground plant tissues. On the other hand, the legumes with the best yields had some of the highest metal concentrations in their foliage. Results of this research suggest that treated mu-nicipal sewage effluent and liquid digested sludge are a valuable resource and can be used to neutralize the site conditions found on strip-mine spoil banks, thus facilitating vegetation. (Kramer-FIRL) W76-03821

POLYMER CONDITIONING OF CHEMICAL

Missouri Univ., Columbia. Dept. of Civil Engineering.
J. T. Novak, and J. H. O'Brien.

Journal Water Pollution Control Federation, Vol 47, No 10, p 2397-2410, October, 1975, 19 fig, 1

Descriptors: \*Sludge treatment, \*Dewatering, \*Polymers, \*Polyelectrolytes, \*Waste water treatment, Water treatment.

Identifiers: Conditioning, Chemical sludges

Chemical sludge conditioning is used to alter sludge characteristics so that dewatering process yields can be improved. An evaluation of the in-fluence of polymers and sludge characteristics on polymer selection and dose requirements for conditioning was performed. The sludge characteristics studied include type of sludge (alum, lime, or iron), pH, percentage of solids, specific re-sistance, filter cake solids, and compressibility. The polyelectrolytes tested varied in the molecular weight, charge, charge distribution, and chemistry of the polymer. Sludge dewatering is improved by the use of high-molecular weight organic polymers which decrease the sludge specific resistance. High-molecular weight organic polymers also increase the sludge compressibility but have negligi-ble effect on filter cake solids concentration. A linear relationship exists between optimal polymer dose and sludge solids concentration. Sludge pH and filter cake solids concentration variations cause differences in dose requirements. The dose requirements have an inverse relationship with polymer molecular weights. Polymers with molecular weights less than 0.000001 are ineffective for chemical sludge conditioning. Selection of polymer also depends on pH. Nonionic to moderate-activity anionic polymers function well between pH 6 and 8.5, while high-activity anionic polymers function well at pH greater than 8.5. Neutral or slightly acidic conditions are best for cationic polymer functioning. (Orr-FIRL) W76-03820

FATE OF WASTEWATER SLUDGE IN THE NEW YORK BIGHT APEX,

State Univ. of New York at Stony Brook. Marine Sciences Research Center.
I. W. Duedall, H. B. O'Connors, and B. Irwin.

Journal Water Pollution Control Federation, Vol 47, No 11, p 2702-2706, November, 1975. 1 fig, 1 tab, 21 ref.

Descriptors: \*Sludge disposal, \*Waste disposal, New York, Microorganisms, Pollutant identifica-tion, Water pollution sources, Organic com-pounds, Centrifugation, Sedimentation. Identifiers: \*Sludges analysis, \*New York Bight.

The impact of dumped sludge in the New York Bight apex is being investigated. The present study reports some values for the total organic carbon (TOC), organic nitrogen, total carbohydrate, and caloric content of dried sludge. It also examined the fate of ocean-dumped sludges on the basis of sludge analyses, some preliminary carbon and nitrogen analyses of sediment from the apex, and recently reported in situ oxygen utilization observations in sediments underlying a sludge disposal area. In-plant waste water sludges were centrifuged to remove the water. The centrifugates were freeze-dried to obtain dry, uncrusted samples. The final sample treatment consisted of homogenizing the freeze-dried samples in a blender. The analysis of dried waste water sludge is presented in a table. When studying the fate of is presented in a table. When studying the tate of dumped sludge, it is important to note the diffusion of sludge immediately after it has been dumped, the rate of decomposition by pelagic and benthic microorganisms, the rate of sedimentation, and the subsequent sediment accumulation. Results indicated that the majority of particulate organic matter in waste water sludge settles near the dump site and quickly decomposes. This ex-plains why unusually high TOC concentrations were not found in the sediments at or the near the dump site. Cutin, a major sludge component, as well as other organic components, can be metabolized by decomposer microorganisms. The carbon to nitrogen ratios of sediments in the dump water area were low; this indicated that nitrogen was not limiting. (Walter-FIRL) W76-03825

BURN THAT SLUDGE, INCINERATION ALONG WITH REFUSE MAY ANSWER SOME ENERGY QUESTIONS, Parsons (Ralph M.) Co., Pasadena, Calif. Systems

Div

B.I. Loran. Water and Wastes Engineering, Vol 12, No 10, p 65-68, October, 1975. 8 fig, 2 tab.

Descriptors: \*Sludge treatment, \*Sludge disposal, \*Incineration, \*Solid wastes, Energy, Waste disposal, Ultimate disposal, Burning. Identifiers: Pyrolysis, Combined refuse/sludge incineration. Domestic refuse.

Restrictions on ocean disposal and loss of landfill space for the disposal of municipal refuse and sewage sludge as well as the energy crisis have caused municipalities to consider incineration as a disposal and energy conserving method. Representative chemical analyses and heat contents of refuse and sewage sludge samples are given. The energy contained in refuse can be recovered after shredding and air classifying by feeding the com-bustible materials into a coal-burning power plant as supplementary fuel or by pyrolizing the refuse to produce low-Btu fuel gas. The extreme dilution of aqueous suspensions of sewage sludge causes the energy content to be less readily available. Total recovery of the energy requies a number of dewatering steps; the recoverable heat usually does not balance the energy necessary for dewatering. Combined refuse/sludge combustion has been practiced. Refuse in the combined treatment supplies the heat necessary to evaporate the water so that combustion of the sewage sludge is selfsustaining. Refuse must be processed (shredded and separated into combustible and noncombustible products) before being used as a supplementary fuel or incinerated with sludge. A multiple hearth furnace is recommended for the disposal of mixtures of refuse and high solids sludge. If there is only a moderate amount of refuse available for combined incineration, then a fluidized bed furnace should be employed. Several commercially available pyrolysis units are discussed. A decision flowchart for choosing the correct disposal method is presented. (Orr-FIRL) W76-03826

ANAEROBIC DIGESTION OF SLUDGE, PART

Pirnie (Malcolm), Inc., Paramus, N.J For primary bibliographic entry see Field 5D. W76-03827

LAND DISPOSAL SITE EXPANDS INTO LIQUID WASTE CONTROL. Waste Age, Vol 6, No 9, p 46-47, 49-50, September, 1975. 9 photos.

Descriptors: \*Waste water disposal, \*Waste disposal, \*Solid wastes, \*Landfills, Ultimate disposal, Municipal wastes, Industrial wastes.

The 226-acre CID (Calumet Industrial Development) Sanitary Landfill is the largest of the 29 sanitary landfills serving the six-county metropolitan Chicago area. The site accepts municipal, commercial, industrial, and demolition wastes. The site is located on an expressway system which links Chicago, the far southern substantial acress the site of the county of th urbs, and northwestern Indiana, near the Little Calumet River which allows long distance barge transfer of wastes from the Great Lakes, and is served by a rail siding permiting railhaul/land reclamation systems. CID originated as a private corporation in 1964, and merged into Waste Management, Incorporated in 1971 and 1972. Its permit from the State of Illinois Environmental Protection Agency allows the disposal of putrescible and nonputrescible solids, and liquid wastes. Water base sludges and other flow flash industrial wastes are disposed of on the landfill without further treatment. Biodegradable materials are neutralized in filtration beds, while pickling liquids

and chromic acids are treated in the neutralization tower with lime. This treatment creates an inert sludge which is used as interim cover in the land-fill. A fleet of five tractors and 19 specialized anker trailers, such as vaccum tankers, stainless tankers, rubber lined tankers and bulk liquid tankers are operated by CID. The site is located in a 90-ft deep vein of highly impervious clay soil which is ideal for waste containment and cover. Three shifts work on two faces of the site. While one face is getting its daily cover, the other site is receiving wastes. (Orr-FIRL) W76-03829

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THE MEANING OF ULTIMATE DISPOSAL, National Environmental Research Center, Cincinnati, Ohio. Advanced Water Treatment Research Lab. R. B. Dean

R. D. Dean. In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 13-21.

Descriptors: \*Waste water disposal, \*Waste water treatment, \*Ultimate disposal, Municipal wastes, Industrial wastes, Pollution abatement, Waste disposal, Drying, Incineration, Solid. wastes, Waste storage, Reuse, Recycling.

Examples of some of the problems associated with the disposal of waste waters are discussed. Ideally, ultimate disposal includes processing and placing wastes where they will not degrade the environment. The main problem is where to place the wastes. Industrial wastes can be discharged, subject to control by permit after suitable purification; they can be evaporated; or they can be reused, after suitable purification. All three of these processes leave residuals; it is the disposal of residuals that is the real problem. If the pollutants in the waste water cannot be sold or a permit for their discharge to the surface or underground be obtained, then they must be put into permanent storage. A permanent lagoon is a permanent liabili-ty and not really a long-term solution due to the fact that the lagoons fill up. The wastes for per-manent storage should be as concentrated as manent storage should be as concentrated as possible; ideally all of the water will be removed. However, the cost of drying must be balanced against the reduced cost of storage. Wastes can be converted into useful products only if the costs of conversion can be justified by the market value of the products. The cost of treatment can be greatly reduced by careful segregation of waste streams, so that the pollutants may be more easily recovered or the cost of drying reduced. (Orr-FIRL) FIRL) W76-03833

WASTES RECYCLING BEFORE FINAL WASTE

DISPOSAL, General Electric Co., Schenectady, N.Y. Environmental Protection Operation.
For primary bibliographic entry see Field 5D.
W76-03838

ULTIMATE DISPOSAL BY MEANS OF DEEP WELL INJECTION: A LEGAL VIEW, Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center. W. E. Cox, and W. R. Walker.

In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 87-103 49 ref.

Descriptors: \*Ultimate disposal, \*Liquid wastes, \*Legislation, \*Legal aspects, Underground waste disposal, Waste disposal wells, Waste water disposal, Injection wells.

The legal aspects of deep well injection for the ultimate disposal of liquid wastes are not well defined. There is no general agreement as to whether injection constitutes ultimate disposal or

is actually just storage. Deep well injection can be considered as the final solution to certain liquid considered as the final solution to certain liquid waste problems as long as a disposal stratum of low utility exists into which the waste can be injected without harmful effects, and the waste can be permanently confined to this stratum. The potential hazards of underground disposal emphasize the need for regulatory controls. It has traditionally been the responsibility of the states for injection well control. State legislation exists in the form of sensitif disposal well statutes according the form of specific disposal well statutes, general pollution control laws, oil and gas laws, and well water statutes. The legislation covers the general subjects of preliminary exploration, well design and construction, operational controls, monitor-ing, and well abandonment. The regulations of the Colorado Board of Health are presented as a model of comprehensiveness. Legal disputes could arise from a variety of sources: well failure resulting in contamination of water supplies or damage to other natural resources; the migration damage to other natural resources; the migration of injected materials into the underlying space of adjacent landowners without the occurrence of measurable damage; and, injection-induced seismic activity. The case law that will be used to provide precedent for resolution of legal differences between private parties is very hazy. (Orr-FIRL) W76-03839

ASSESSING PHYSICAL POTENTIAL FOR DEEP DISPOSAL OF INDUSTRIAL WASTES BY WELLS IN THE SOUTHEASTERN UNITED

STATES, Virginia Polytechnic Inst. and State Univ., Blacksburg. Div. of Environmental and Urban

Systems.
J. E. Hackett, J. Hayman, and S. Lewis.
In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 104-120. 4 fig, 2 tab, 10 ref.

Descriptors: \*Ultimate disposal, \*Liquid wastes, \*Underground waste disposal, \*Feasibility studies, Geologic investigations, Geographical regions, Geological surveys, Waste disposal wells, Injection, Hydrogeology, Hydrologic aspects, Southeast U.S.

A study was conducted of the physical potential for deep well disposal of wastes in the Mid and South Atlantic States. The basic steps in the general procedure for regional assessment include: the identification of geologic, hydrologic, and geochemical criteria for suitable disposal environments; the identification of the regional physical framework in terms of factors relevant to deep well disposal; and assessing the characteristics of well disposal; and, assessing the characteristics of the regional framework in terms of stipulated criteria to determine the relative favorability of various environments with regard to deep disposal. A comprehensive review of the literature identified twenty environmental factors which determine the physical feasibility for deep well disposal. The geologic provinces and subprovinces disposal. The geologic provinces and subprovinces which constitute the primary physical framework, and regional seismicity patterns which determine tectonic stability are discussed for the Mid and South Atlantic states. Assessment of the physical potential for deep disposal varies according to the type of waste. This study separated brines, liquid industrial wastes (subdivided into non-acid and acid), and radioactive wastes, including liquid adjustative and radioactive materials. acid), and radioactive wastes, including inquio radioactive and radioactive cement slurry. The crystalline Piedmont Province is unfavorable for injection disposal due to the lack of confinement conditions. The most favorable province is the Coastal Plain due to the lateral continuity of stratigraphic units and the opportunity for confinement of disposed wastes. Tectonic activity is a constraining factor in South Carolina. (Orr-FIRL) W76-03840

ULTIMATE DISPOSAL OF WASTEWATERS, Environmental Protection Agency, Washington, D.C. Office of Research and Monitoring.

S. M. Greenfield.

In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 121-

Descriptors: \*Research and development, \*Federal Water Pollution Control Act, Financing, Projects, Technology, Water reuse, Recharge, Ir-rigation, Reclaimed water.

The Environmental Protection Agency provides financial support for projects for the development of water reuse technology to help meet the goals of the 1972 Federal Water Pollution Control Act. EPA supports the continued development and implementation of waste water reclamation, reuse, recycling, and recharge. Emphasis is placed on the recycling, and recharge. Emphasis is placed on the potential for waste water reuse in agricultural, industrial, municipal, recreational, and groundwater recharge applications. The direct interconnection of waste water reclamation plants with municipal water treatment plants, and projects including procedures for the rapid identification and removal of viruses and organics, epidemiological and toxicological analyses advanced water water. and toxicological analyses, advanced waste water drinking water treatment process design and operation, development of water quality requirements for various reuse opportunities, and cost-ef-fectiveness studies are not currently supported by EPA. Eighteen major waste water reuse projects for a total investment of \$5,400,000 have been supported by EPA. Among these projects are ones at Lake Tahoe, Santee, and Antelope Valley, California. Most of the EPA funded research in the fiscal year 1973 was concerned with land treatthe liscal year 1975 was concerned with land treat-ment systems for effluents and sludges. Well-known EPA financed projects in this area are groundwater recharge at Whittier Narrows, California, Pennsylvania State University's project, and the Muskegon, Michigan, spray irrigation project. (Orr-FIRL) W76-03841

SLUDGE HANDLING AND DISPOSAL-STATE OF THE ART, Delaware Univ., Newark. Dept. of Civil Engineer-

ing. R. I. Dick.

In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 127-142. I fig, 27 ref.

Descriptors: \*Waste water treatment. \*Sludge treatment, 'Sludge disposal, Facilities, Costs, De-watering, Ultimate disposal, Sedimentation, Cen-trifugation, Flotation, Coagulation, Polyelec-

Identifiers: Filter presses, Vacuum filtration, Thickening, Conditioning, Pasteurization.

A critical analysis of the state of the art of sludge A cruical analysis of the state of the art of sludge handling and disposal is presented. In addition, the attitudes towards sludge treatment and disposal that have determined the nature of present prac-tices are discussed. Sludge treatment and disposal account for 25 to 50% of the total cost of waste management; they are the largest single factor in the total cost of operating and maintaining waste water treatment facilities. Sludge treatment and water treatment facilities. Studge treatment and disposal systems involve thickening, conditioning, dewatering, conversion, transportation, and ulti-mate disposal. A significant reduction in sludge handling costs can be achieved by effective thickening. Thickening is accomplished by gravity sedimentation, by dissolved air pressure flotation, and by centrifugation. Organic chemical coagulants, such as ferric chloride and lime, are the most common chemical conditioners, but the use of common chemical condutioners, but the use of synthetic organic polyelectrolytes is increasing. Dewatering sludges makes them more amenable to solids handling procedures, reduces their volume, and increases their fuel value. Vacuum filtration and filter pressing are used for dewatering. Conversion include anaerobic digestion, combustion, aerobic digestion, composting, disinfection, and

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pasteurization. Current attitudes towards sludge handling and disposal do not constitute the most rational approaches. A system of regional sludge handling facilities is suggested. Sludge handling needs to be incorporated into the total waste treatment scheme, not left as an afterthought, as it is currently left in many cases. (Orr-FIRL)

# SLUDGE RECYCLING: THE WINSTON-SALEM EXPERIENCE,

F. C. Styers.
In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 143-152.

Descriptors: \*Sludge treatment, \*Sludge disposal, \*Recycling, Fertilizers, Dehydration, Industrial wastes, Sewers, Waste water treatment, Treatment facilities, Ultimate disposal.

A brief description is presented of the composition of the Winston-Salem industrial community, its sewer use ordinance, and its waste water treat-ment facility as background to the Winston-Salem sludge recycling project. The sludge was originally air dried and then offered free-of-charge to local farmers. When it became apparent that the amount of sludge produced was greater than could be utilized locally, a dehydration plant was constructed. This plant dehydrated the air-dried sludge and made it available to the public either in bags or bulk. The product of this plant was officially bulk. The product of this plant was officially named Grogonite. There was no problem with producing a saleable product from the city's sludge. However, many legal problems hampered the marketing of the Grogonite. Winston-Salen now has a contract with Orgonics, Incorporated of Rhode Island. Orgonics will blend the sludge for formaldehyde and urea and produce a product (Organiform-SS) which contains 16% nitrogen. Orgonics will then sell this product to chemical manufacturers who will use it in blending various fertilizers. The dehydration plant facility is being modified to produce the new product. For each tone of Organiform-SS that is sold, the city will receive \$5. (Orr-FIRL) W76-03843

# HAULING DIGESTED SLUDGE IN TANK

General American Transportation Corp., Chicago, III.

M. S. Kostolich. In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 178-185. 2 fig.

Descriptors: \*Sludge treatment, \*Sludge disposal, \*Ultimate disposal, Transportation, Railroads, Waste disposal, Costs. Identifiers: Waste freighters.

A system for removing sludge from municipalities for disposal at a remote site is explained. The system uses railroads and specially designed cars hooked into unit trains. The system is called the Waste Freighter. The basic vehicle is a GATX 20,000 gallon tank car with special fittings. Sludge can be loaded through the top of the tank through a quick-operating manway cover, or through a loading connection at the bottom of the tank. Sludge is unloaded through a 12 inch valve at the bottom of the tank which can be equipped with a movable chute to direct the sludge beyond the rail ties. The tank car can hold about 80 tons of sludge; overloaing is prevented by a ball float device which autonatically shuts off the flow at the desired level. Two loading systems have been designed (indoor and outdoor) which can adapt to any combination of sludge volume vs. desired loading times. The use of the Waste Freighter in a hypothetical city which produces a volume of sludge equivalent to about 4 million people is discussed. Using a 80 car unit train, a 200 mile trip to the application site (a strip mine to be reclaimed), and 7000 tons of wet sludge with 6% solids by weight, the cost to the city for this service would be less than two dollars per ton. The Waste Freighter eliminates capital investment in costly new sludge treatment facilities and a transportation system, conforms to present and future pollution standards, and can be easily expanded by increasing the number of tank cars. (Ort-FIRL)

# THE EFFECT OF INCINERATION ON METALS, PESTICIDES, AND POLYCHLORINATED BIPHENYLS IN SEWAGE SLUDGE,

National Environmental Research Center, Cincinnati, Ohio. Advanced Waste Treatment Lab. For primary bibliographic entry see Field 5D. W76-03845

# THE OCEANS AS ULTIMATE SINKS FOR WASTEWATERS AND WASTEWATER PESIDUALS

RESIDUALS, Duke Univ., Beaufort, N.C. Marine Lab. R. T. Barber, and W. Kirby-Smith.

In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 199-213. 3 fig, 1 tab, 23 ref.

Descriptors: \*Waste water disposal, \*Sludge disposal, \*Oceans, \*Environmental effects, Legislation, \*Ultimate disposal, Waste assimilative capacity.

Identifiers: Ocean disposal, Benthic waters.

The Ocean Dumping Law, H.R. 9727, prohibits dummping of radiological, chemical, or biological warfare agents or high level radioactive wastes, and provides for the strict regulation of any material which could adversely affect human health, welfare, the marine environment, ecological systems, or economic potentialities. The ecological response to certain kinds of intentional waste dumping are discussed, and a basis is provided for the value judgements required to deter-mine if a given ecological response is an adverse effect. The deep ocean ecosystem is a high diversity system, containing a large number of species. High diversity systems are stable under a constant environment, but are fragile when faced with environmental variations. Thus, ocean disposal would adversely affect the deep ocean systems if the ocean dumping produced changes in the environment. Research has determined that microbial turnover rates in the deep ocean are very slow. Work performed with the submersible Alvin of the Woods Oceanographic Institution on microbial degradation in deep ocean systems is described. The low turnover rates indicate that organic rich waste would accumulate on the ocean bottom if dumped beyond the continental shelf. The organic overload from a short period of dumping could last for centuries or longer. There is evidence that the relatively rapid degradation of certain wastes by deep sea metazoans is adapted only to these specific food resources; organic wastes such as sewage sludge would have to be degraded by the microbial populations rather than by metazoans. (Orr-FIRL)

# DETERMINING ULTIMATE CAPACITY OF THE COASTAL ZONE FOR WASTEWATER AND WASTEWATER RESIDUALS, Rosenstiel School of Marine and Atmospheric

W76-03846

Rosenstiel School of Marine and Atmospher Science, Miami, Fla.

J. H. Carpenter.
In: Ultimate Disposal of Wastewaters and Their
Residuals, April 26-27, 1973, Raleigh, North
Carolina, Research Triangle Universities, p 216-

Descriptors: \*Waste water disposal, \*Sludge disposal, \*Oceans, Environmental effects, Waste assimilative capacity, Ultimate disposal, Continental shelf, Coasts.

Identifiers: Ocean disposal, Coastal waters.

The following factors are important when considering the capacity of coastal waters for assimilating waste waters: conditions leading to possible transmission of bacterial, viral or parasitic human diseases; contamination of seafood with toxic chemical substances; and, changes in the physical and chemical characteristics of the waters and sediments which will cause changes in the abundance and diversity of marine life. Since the different areas of the coastal zone of the United States have different physical and biological systems, emission standards must be developed on a regional basis. A hypothetical situation is discussed: the disposal of a well digested, dispersible, and sterile sludge into the northeast coastal zone. The effects of disposal on transparency, nutrients, dissolved oxygen concentration, and heavy metals are discussed. Altered transparency, nutrient concentrations, and dissolved oxygen concentrations are identified as controlling factors to avoid degradation of shelf waters. A large dilution factor is a possible acceptable design criterion for these factors. However, the dilution factor is so large that to dispose of the total sludge production in the year 2000 would require the total renewal of shelf water for adequate dilution. Alternatives to ocean disposal include thickening and then burial in submarine landfills, incineration, and land disposal. These alternatives have their own limitations. Continued attention to limited ocean disposal will be necessary where no practical alternate can be developed. (Orr-FIRL) W76-03847

#### LAND DISPOSAL: STATE OF THE ART,

Cold Regions Research and Engineering Lab., Hanover, N.H.

In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 229-258. I tab, 42 ref, I append.

Descriptors: \*Waste water disposal, \*Irrigation, Waste water treatment, Sewage effluents, Environmental effects, Potable water, Water quality, Overland flow, Infiltration, Sprinkler irrigation. Identifiers: Spray irrigation, Rapid infiltration, Land application.

A multidisciplinary comprehensive technical assessment of the effectiveness and effects of land disposal of secondary treatment effluents has been performed. Spray irrigation is the controlled spraying of inches of liquid per week onto the land, with an infiltration and percolation flowpath within the boundaries of the site. Overland runoff is the controlled discharge of inches of liquid per week onto the land, with a down-slope sheet flow-path. Rapid infiltration is the controlled discharge of feet of liquid per week onto the land; the flow path is high rate infiltration and percolation. The quality of the product water from land disposal methods should be close to potable/irrigation water standards. Any of the application modes can meet the quality standards if proper site conditions exist and proper operational criteria are used. Spray irrigation is the most reliable method, followed by overland runoff and then rapid infiltration. Either primary or secondary effluents can be applied by spray irrigation or overland runoff methods and still achieve sufficient product quality. The land disposal site should be treated as a neglected waste sink. The pretreatment steps and the site must be managed as a total system to produce optimum responses. (Orr-FIRL)

AN EVALUATION OF THE ACCUMULATION, TRANSLOCATION, AND DEGRADATION OF PESTICIDES AT LAND WASTEWATER DISPOSAL SITES, California Univ., Berkeley. Sanitary Engineering

Research Lab

For primary bibliographic entry see Field 5B.

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#### RECYCLING ALLOWS ZERO WASTE WATER DISCHARGE.

Black, Crow, and Eidsness, Inc., Clearwater, Fla. L. A. Dove.

Civil Engineering, Vol 45, No 2, p 48-50, (February 1975). 3 p, 1 fig, 4 photo, 1 tab.

Descriptors: \*Florida, \*Waste water treatment, \*Injection wells, \*Recycling, Viruses, Research and development, Underground waste disposal, Municipal wastes, Environmental sanitation, Filtration, Sewage treatment, Waste water disposal,

Sludge, Quality control.
Identifiers: \*Waste water recycling, Virus inactivation, In-plant bacteria, Land disposal.

Waste water recycling can provide a safe, de-pendable supply of water for irrigation, power plants, industries, and other non-potable urban uses. Several incentives for total waste water recycling are described. One of the most important is the elimination of the massive use of scarce chemicals and electric power required by typical chemicals and electric power required by typical advanced treatment facilities. The city of St. Petersburg, Florida has committed itself to total recycling of its waste water with zero discharge to its surrounding bays. In-plant bacteria, and virus inactivation, controlled natural utilization of nutrients, and 100% backup of deep well injection are key factors in the design of the city's system. Under this system the digested sludge from the treatment leads to will be reused for controlled truck treatment plants will be reused for controlled truck spraying at selected sites and as fertilizer on a 150 acre city-owned sod farm and nursery. The actual treatment and quality control processes of the St. Petershburg system are described. The advantages of the spray irrigation method used by St. Petersburg over the overland runoff and rapid infiltration pond methods of land disposal are also described. (Hoffman-Florida) W76-03926

### CRITERIA FOR THE EVALUATION OF PER-MIT APPLICATIONS (OCEAN DUMPING). Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G.

## EMERGING ISSUES IN FEEDLOT WASTE MANAGEMENT,

Texas A and M Univ., College Station. For primary bibliographic entry see Field 5G. W76-03968

### MANAGE MANURE FOR ITS VALUE,

Wisconsin Univ., Madison. Coll. of Agricultural and Life Sciences.
L. M. Walsh, R. F. Hensler, and E. E. Schulte

Circular A1672, Wisconsin Agricultural Extension Service, Madison, May, 1975, 6 p. 5 fig, 3 tab.

Descriptors: \*Farm wastes, \*Solid wastes, \*Liquid wastes, \*Crop response, Odor, Lagoons, Agricultural runoff, Leaching.
Identifiers: \*Nutrient conservation, \*Land Identifiers: \*Nutrient disposal, Volatilization.

Although manure is a valuable by-product of the livestock industry, only a fraction of its potential crop-producing value is realized. Some of the reasons are: poor distribution when applied; ru-noff losses; leaching; and volatilization. The pur-pose of this report is to discuss the fertilizing value of manure, the quantity and composition of manure produced by Wisconsin livestock, and the methods of conserving and handling manure. Manure adds nitrogen, phosphorus, organic matter, potassium and other elements such as magnesium, boron, copper, calcium, sulfur, manganese and zinc to the soil. Factors affecting manure composition are the kind and amount of litter, the kind of animal, digestibility of the feed consumed and handling and storage procedures. consumed, and handling and storage procedures The distribution of nutrients in liquid and solid manure is discussed. Of the crops which can utilize nitrogen and other nutrients from the manure, corn responds best. Several methods of conserving nutrients are: (1) reduce liquid losses, (2) consider chemical preservatives, and (3) reduce volatilization losses. Methods for solid manure handling that are discussed are: (1) daily-spread manure, (2) stacked manure, and (3) loose housing manure. Liquid systems of manure handling in-clude: (1) aerobic lagoons, and (2) anaerobic lagoons. Chlorine and hydrated lime are important chemicals in the control of odor. (Penrod-East W76-03969

#### CHINO VALLEY SHAKER.

G. Ashfield. Dairy Herd Management, Vol 11, No 4, p 22-27, April, 1974. 7 fig.

Descriptors: \*Farm wastes, \*Dairy industry, \*California, \*Fertilizers, Odor, Sprinkler irrigation, Waste disposal, Identifiers: \*Waste management, Storage ponds, \*Land disposal, Chino Valley(Calif).

Manure is neither an asset nor a liability but simply one of two products of the more than 700 dairy animals housed at the C. S. Musser and Sons Inc., producer/distributor dairy operation. The waste collection and handling program is organized with all the care and planning normally reserved exclu-sively for the prime dairy product, milk. In full cycle, the manure is flushed, pumped, separated, and stored in both solid and liquid form prior to its use as bedding and fertilizer. An intensive 13 month study was conducted to evaluate the workings of the waste retention pond. Specific goals of the study were to determine: (1) the effect of dairy waste as a pond sealant; (2) the chemical and biological action in, around and under the pond. The waste pond became effectively sealed from excess infiltration in not more than 55 days after inflow of screened dairy sewage. Odor emisarter inflow of screened early sewage. Odor emissions from the pond were not severe enough to create a neighborhood nuisance and the pond did not create a fly problem. Sufficient acreage of irrigated cropland to permit effective pond management and post-pond discharge of the contents is essential to make this type of pond and the accompany of the contents of the c panying waste disposal environmentally accepta-ble. (Cartmell-East Central) W76-03976

#### SOLID WASTE HANDLING,

Pennsylvania State Univ., University Park. A. R. Grout. Dairy Herd Management, Vol 11, No 4, p 12-13,

Descriptors: \*Solid wastes, \*Slurries, \*Dairy industry, \*Waste storage, \*Storage tanks, Storage requirements, Waste treatment, \*Farm wastes. Identifiers: \*Waste management, Land disposal, Stackers, Free stall barns, Manure ponds.

While processes such as dehydration, composting, and recycling into methane are being used on manure, the best bet for most dairymen is the use of cropland as the processing medium. This generally means that manure has to be stored until proper time for land disposal. Long elevators or mechanical throwing devices are needed for stall barn manure because it will not flow. Different methods for water removal from the manure are discussed. The manure itself is transported to a

stacker enclosure which, in most cases, is built of stacker enclosure which, in most cases, is built of reinforced concrete. Storage capacity is figured at 1.5 cu. ft. per 1,000 pound animal unit. Capacity of storage is usually planned for a period of six months or more. Roofs over these structures are optional but desirable. Manure storage for free stall barns is stored 'as produced' as a heavy slurry with very little added bedding material. The free stall barn can be cleaned with a tractor scraper or by the new automatic scrapers. Conveyance to the storage basin can be by gutter cleaner chain, or by pushing the manure through an underground pipe with a special ram pump. The storage enclosure for this type manure is usually built below ground level with reinforced concrete walls on three sides. One end has a sloped entrance floor up to the wall level which allows manure to be brought up the ramp with a tractor loader. The spreader can be backed into the basin as the level recedes due to manure removal. Use of manure ponds with earth manufer tenious. Use of manufer points with earlier walls like a farm pond is also gaining acceptance for storage of this type of manufer slurry. (Merryman-East Central) W76-03977

### IMPACTS OF IMPOSING SELECTED POLLU-

TION CONTROLS,
Michigan State Univ., East Lansing. Dept. of Agricultural Economics For primary bibliographic entry see Field 5G. W76-03982

STATUS OF THE ILLINOIS LIVESTOCK WASTE MANAGEMENT REGULATIONS, Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control. For primary bibliographic entry see Field 5G. W76-03984

## DETERMINING APPLICATION RATES OF LIVESTOCK WASTES TO THE LAND,

Illinois Univ. at Urbana-Champaign. Soil Fertility Extension.

For primary bibliographic entry see Field 5B.

SUMMARY OF KANSAS' EXPERIENCE WITH LIQUID WASTE SPREADING, Kansas State Univ., Manhattan. Dept. of Agricultural Engineering; and Kansas State Univ., Manhattan. Dept. of Agronomy.
H. L. Manges, L. S. Murphy, and W. L. Powers.
Presented at Midwest Livestock Waste Manage-

ment Conference, Iowa State University, Ames November 27-28, 1973, 9 p. 2 fig, 3 tab, 3 ref.

Descriptors: \*Farm wastes, \*Kansas, \*Agricultural runoff, \*Lagoons, Fertilizers, Nutrients, Crop response, Salt tolerance, Chemi-\*Kansas, Fertilizers, cal properties. Identifiers: \*Land disposal.

The cattle feeders of Kansas are controlling surface water pollution by catching and storing feedlot runoff in lagoons. In Western Kansas, collected runoff is evaporated since evaporation greatly exceeds rainfall. Remaining feedlots resort to land disposal of the runoff. Since land applica-tion of runoff hasn't been practiced very much, little is known about application rates. The purpose of this report is to examine and determine the pol-lution potential from high application rates of feedlot wastes to land. The study showed that snowmelt runoff pollutants concentration is 2 to 2 1/2 times of rainfall. Runoff storage in lagoons results in pollutants concentration increasing with the evaporation of pure water. Recommendations for runoff analyses are given. If runoff is applied as a fertilizer it should be applied at rates necessary to supply the nutrients required by the crop grown. Fertilizer recommendation for the area could be used as one criteria. Guidelines and recommendations were given for feedlot runoff application onto land. Average annual application

### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5E-Ultimate Disposal Of Wastes

rates of 5, 5 and 9 inches in 1971, 1972, and 1973. respectively resulted in top corn forage yields in Kansas. Salt buildup in the soil will eventually determine application rates. (Penrod-East Central)

OUTDOOR, UNPAVED FEEDLOT MANAGE-

Nebraska Univ., Lincoln, Agricultural Experiment

J. A. Nienaber, and G. B. Gilbertson

Presented at Midwest Livestock Waste Management Conference, Iowa State University, Ames, November 27-28, 1973, 19 p. 2 fig, 4 tab, 16 ref.

Descriptors: \*Farm wastes, \*Feed lots, \*Design, \*Agricultural runoff, Drainage, Mud, Snowmelt, Irrigation.

Identifiers: Unpaved feedlots, \*Waste management, Holding ponds, Debris basins.

This report summarizes recommended management practices for control of waste from outdoor, unpaved feedlots. Area requirements for cattle, mound construction, and drainage are discussed in terms of basic requirements for satisfactory feedlot performance. Mud problems must also be considered in the design and management of the feedlot. The three basic components of a runoff control system are: holding pond, debris basin, and disposal area. Suggestions for the design and management of the feedlot, debris basin, holding pond and disposal area are given. Facilities should be planned which provide for a reduction of cattle density to 500 ft2/head during winter operations. Mounds should be constructed parallel to the lot slope and should be connected with the feedbunk and waterer. A minimum of 1.25 ac-in/acre volume should be provided if overflow is collected by the holding pond. If the overflow cannot be collected by the holding pond, 70% of the 10 year, 24-hour storm should be provided for. An excessive snow-melt should be anticipated every 2-3 years; although reduced cattle density will relieve the resulting muddy conditions. There should be a minimum holding pond storage volume of 100% of the 10-year, 24-hour storm. An existing irrigation system should be used if possible; otherwise, the minimum area for liquid disposal is 1/2 acre of pasture per acre of feedlot. (Penrod-East Central) W76-03989

LIVESTOCK WASTE MANAGEMENT IN A QUALITY ENVIRONMENT, Illinois Univ. at Urbana-Champaign. Cooperative

Extension Service. For primary bibliographic entry see Field 5D. W76-03991

STUDIES ON SUBSURFACE MOVEMENT OF EFFLUENT FROM PRIVATE SEWATE DISPOSAL SYSTEMS USING RADIOACTIVE

AND DYE TRACERS, PART 2, 1973-74, Ontario Ministry of the Environment, Toronto. For primary bibliographic entry see Field 5B.

### 5F. Water Treatment and **Quality Alteration**

PROCESS AND INSTALLATION FOR THE REATMENT OF WATER AND OTHER LIQUIDS

Abwassertechnik und Kunst stoffbau GmbH, Waiblingen (East Germany). (Assignee). For primary bibliographic entry see Field 3A. W76-03515

SELF-CONTAINED WATER TREATMENT SYSTEM, K. F. Elkern.

U S Patent No 3,920,552, 4 p, 5 fig, 15 ref; Official Gazette of the United States Patent Office, Vol 940, No 3, p 1371, November 18, 1975.

Descriptors: \*Patents, \*Water treatment, \*Reclaimed water, \*Water pollution control, \*Aeration, \*Mixing, Bodies of water, Lakes, Streams, Rivers, Rehabilitation, Chemical treat-

Water treatment equipment is provided which can be selectively used for both aerating and chemi-cally treating water. The system comprises a mixing tank which has means for drawing ambient water from a nearby lake, stream, or river. Air or chemicals are introduced into the water and thoroughtly mixed thereby treating the water. The treated water is then returned to the ambient water where it is thoroughly mixed by means of a turbine mounted at the end of a conduit. The water treatment unit is completely self-contained and can be mounted on a truck body or trailer and then moved to whatever lake or stream that needs to be treated. (Sinha-OEIS) W76-03519

EXPERIMENTAL RESEARCH DATA ON HY-GIENIC EVALUATION OF THE METHOD OF MAGNETIC TREATMENT OF WATER, (IN

RUSSIAN), Nauchno-Issledovatelskii Institut Moscow (USSR).

For primary bibliographic entry see Field 5C. W76-03536

RADIOCHEMICAL METHODOLOGY FOR DRINKING WATER.

Environmental Monitoring and Support Lab., Cincinnati, Ohio. For primary bibliographic entry see Field 5A.

DESIGN AND OPERATION OF HIGH-RATE FILTERS-PART 1, Montgomery (James M.), Inc., Pasadena, Calif.

Water Treatment Div. For primary bibliographic entry see Field 5D. W76-03665

MICROSCREENING AND DIATOMITE FIL-

TRATION, New York State Dept. of Health, Albany. S. Syrotynski, and D. Stone. American Water Works Association Journal, Vol 67, No 10, p 545-548, October, 1975. 3 fig, 7 tab, 3

Descriptors: \*Diatomaceous earth, Microorganisms, Plankton, \*Water treatment, \*Filtration, New York, Treatment facilities, Pre-treat-ISMS, FIGUREON, Walls of the Mey York, Treatment facilities, Pre-treatment facilities, Pre-treatment (Water), Analysis, Screens.
Identifiers: \*Diatomite filters, \*Microscreening, Microscopic particles, Geneva(NY).

Four microscreening units have been installed in New York State since 1961 as pretreatment processes. The existing water quality information as related to the performance of these units in New York is studied and the microscopic-removal performance of a water plant using a microscreening-diatomaceous earth-water treatment process is evaluated. Previous studies on microscreens have found a 90.4% average reduction in plankton concentration; a 44.6% average reduction in the con-centration of total microscopic particles; and, a microstrainer effluent with a more uniform concentration of plankton and total microscopic count than present in raw water. Tests in New York have found that microscreening is effective in removing microscopic particles and that diatomaceous earth filters are even more effective, but if there are excessive total counts of microscopic particles, the filtration times would be cut down. These two methods were tested in conjunction in the Geneva. NY, water supply system. Six filtration cycles were used in the tests. Analyses were conducted pre- and post-micro-screening and after diatomite filtration. These tests showed that the use of These tests showed that the use of micro-screening as a pretreatment process lengthened the filter runs for the diatomite and slow sand filters. Diatomite filtration achieves more acceptable levels of microscopic particles than microscreening. Data are too limited to compare the efficiency of removals by different sized microscreens. (Pinto-FIRL) W76-03671

WATER OZONATION PLANT AT WROCLAW (STACJA OZONOWANIA WODE WE WROCLAWIU), B. Jasinski, A. Madrecka, A. Olech, and K.

Gaz, Woda i Technika Sanitarna, Vol 49, No 6, p 187-191, 1975. 11 fig, 3 ref.

Descriptors: \*Water treatment, \*Ozone, Treatment facilities, Tanks, Equipment, Odor, ment facilities, Chlorination.

An ozonating station for water treatment is described. Its chief components are ozone genera-tors and contact tanks. Each generator consists of a cylindrical stainless steel body with steel tubing containing dielectric pipes. The tubing is connected with two chambers, one of which is fed dry air, while the other accumulates ozonated air. A ring-shaped space between the metal and dielectric tubing is maintained in which air or oxygen is converted into ozone by means of an electrical discharge. Contact between ozonated air and water occurs in the contact tank which is made up of three parallel-arranged contact chambers. Each chamber has five compartments of water contact occurs between the first and the second and between the fourth and the fifth compartments of each chamber. Ozone is supplied to the second and third compartments, where excess ozone in the water is first produced and then maintained. This arrangement results in a level of 2 mg/liter of ozone at a daily output of 180 cu m over a period of 21 min in the three parallel-arranged chambers. Ozone utilization achieves a quality of water conforming to health regulations, reduces color, returns normal odors, and normalizes bacterial composition in the water. Further, it eliminateds the need for initial chlorination and reduces the doses of final chlorination to the prophylactic level, thus limiting corrosive conditions due to the C12 effect. The mean atmospheric ozone concentration in the ozonating station is between 0.02 and 0.15 mg/cu m. (Tallert-FIRL) W76-03674

OZONE DISINFECTION PILOT PLANT STU-DIES AT LACONIA, NEW HAMPSHIRE, Laconia Water Works, N. H.

R. A. Morin, J. W. Keller, T. J. Schaffernoth, and D. R. Paquette.

Journal of the New England Water Works Association, Vol 89, No 3, p 206-224, September, 1975. 1 fig, 7 tab.

Descriptors: \*Ozone, \*Disinfection, \*Viruses, \*Water treatment, \*Activated carbon, \*Pilot plants, \*Treatment facilities, New Hampshire, Water supply, Lakes, Operating costs, Capital costs, Filtration, Adsorption, Chlorination.

A treatment system using activated carbon adsorption and ozone to effect virus inactivation was tested for the water supply at Laconia, New Hampshire. Pilot plant studies were conducted to substantiate the effectiveness of ozone as a vericidal agent and to establish the required dosage and contact time. A cost analysis for a proposed Ozone-Activated Carbon plant was also performed. Based on the pilot plant experiments, an ozone dosage of 1.0 to 1.25 ppm would provide adequate viral and bacterial disinfection of the relatively clean lake water. The construction and

### WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Treatment and Quality Alteration—Group 5F

annual operating costs of the treatment scheme, including pretchlorination at 1.5 ppm, activated carbon filtration and adsorption, disinfection with 1.20 to 1.50 ppm ozone and post-chlorination at 0.2 ppm were determined. (Kramer-FIRL) W76-03688

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TUBE-SETTLERS: THEORY AND PRACTICE, Indian Inst. of Tech., New Delhi. Dept. of Civil Engineering. R. C. Singh.

Indian Journal Environmental Health, Vol 17, No 2, p 152-163, April, 1975. 4 fig, 2 tab, 7 ref.

Descriptors: \*Sedimentation, \*Design criteria, \*Filters, \*Water treatment, Water demand, Water resources development, Settling basins. Identifiers: Tube settlers, India

Design criteria for sedimentation basins using tube-clarifiers are presented, based on work done in India. Two cases were detailed using rectangular and circular sedimentation tanks. The surface area loading rate is the most important design criterion for such tanks. The angle of inclination for the tube settlers was discussed. Plastic tubes with light weight and long life-spans, manufac-turered as a 'tube-module' have provided for simple and inexpensive installation. It was found possible to increase the capacity of existing rectangular clarifier tanks by 100 to 200% and that of circular tanks by up to 100%. When these are used in conjunction with mixed-media filters, the capacity of an existing waterworks can be tripled without additional facilities construction. The importance of design techniques for newly develop-ing nations was emphasized. (Kramer-FIRL) W76-03689

OZONATION OF WATER: ROLE OF HYDROXYL RADICALS AS OXIDIZING INTER-

Eidegenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).

J. Hoigne, and H. Bader.

Science, Vol 190, No 4216, p 782-784, September, 1975. 3 fig, 1 tab, 8 ref.

Descriptors: \*Ozone, \*Water treatment, \*Waste water treatment, \*Model studies, Kinetics, Analytical techniques. Identifiers: Hydroxyl radicals, \*Ozonation.

Ozone is used as the oxidizing agent for water and waste water treatment in various countries. Extensive literature on reactions involving hydroxyl radicals may be applied to evaluate and optimize these ozonation processes. Experiments were conducted which showed that ozone reacts with substrates in water by two different pathways and that hydroxyl radicals are important oxidative intermediates formed in the decomposition of ozone. A reaction scheme was tested. It was demonstrated that types of oxidants involved in the reaction could be identified from the relative rates at which parts of substrates compete with each other for the oxidant. Thus, the previously recorded and present experimental data on the reactions of hydroxyl radicals may be used to describe oxidations following ozone decomposition. (Kramer-FIRL) W76-03703

STUDIES ON THE ADSORPTIVE EFFECT OF ACTIVATED CHARCOAL ON POLYCHLORINATED BIPHENYLS IN WATER (YOZON PCB NO KASEITAN KYUCHAKU SHORI NI KANSURU KENKYU), M. Kondo, T. Kishi, T. Shimamoto, T. Nishihara,

and K. Watabe.

Osaka Daigaku Yakugaku Kiyo, (Memoirs of the Faculty of Pharmaceutical Sciences), Vol 18, p 135-138, 1974. 7 fig, 5 ref.

Descriptors: \*Water treatment, \*Activated car-bon, \*Adsorption, \*Polychlorinated biphenyls, Organic compounds, Laboratory tests, Mixing, \*Waste water treatment.

The effectiveness of activated carbon adsorption of polychlorinated biphenyls (PCB) in water was investigated. PCB solution was mixed with activated carbon, and the adsorption rate of low chlorinated derivatives was found to be higher than that of high chlorinated derivatives. These results agreed with those of an activated carbon column method. Adsorption activity of the carbon was effected more by the diameter of the carbon particle than by the volume of carbon. The 70-145 mesh particles were the most effective. (Kramer-FIRL) W76-03715

SOCIAL AND ECONOMIC DEVELOPMENT CRITERIA IN POTABLE WATER AND SEWERAGE SYSTEMS (CRITERIOS SOCIALES Y ECONOMICOS DE DESSARROLLO EN LOS SISTEMAS DE AGUA POTABLE Y ALCAN-TARILLADO).

M. B. Ahumada. Recursos Hidraulicos, Vol 4, No 2, p 216-222, 1975. 2 tab.

Descriptors: \*Potable water, \*Sewage, \*Water quality control, \*Water quality standards, \*Water rates, Community development, Costs, Rural areas, Construction, Water costs, Operating costs, Treatment facilities, \*Mexico.

Rates for potable water and sewerage systems in Mexico date from about two decades ago. However, the cost of living has risen dramatically in the past few years, causing increased operating costs. Thus, the water and sewage treatment systems do not have available income to cover their service costs nor to pay amortization of and interest on invested capital. There is little financing for necessa ry expansion or rehabilitation. The problem of restructuring present rates is discussed. Governmental policy emphasizes educating the user regarding the benefits received from adequate potable water and sewerage service. Community par-ticipation in the construction and maintenance of new facilities is strongly urged to insure higher standards of living in this country. (Kramer-FIRL) W76-03808

RETOOLING THE WATER WORKS INDUS-

TRY, Stevens, Thompson and Runyun, Inc., Portland, Oreg. F. C. Cooper.

Public Works, Vol 106, No 11, p 72-73, November, 1975, 2 fig.

Descriptors: \*Water treatment, \*Water analysis, \*Laboratory tests, Ozone, Viruses, \*Treatment facilities, Toxicity, Heavy metals, Iron, Turbidity, Research and Development.

The available new technology for the water treatment industry was reviewed. Much of this technology has not yet been demonstrated in largescale water treatment plants. The most common water treatment process--alum coagulation, set-tling, and chlorination--is not totally effective in removing toxic materials. Organic removal requires different techniques, varying with local conditions. Activated carbon treatment and ozonation are offered as alternatives for disinfection. To destroy pathogenic bacteria and viruses, it has been found that a single disinfectant or treatment process is not always sufficient. Overly polluted river sources often require pre-ozonation or su-perchlorination followed by dechlorination with activated carbon or sulfur dioxide. Inorganic contaminants must also be treated by special methods. Some toxic chemicals, such as lead, mercury, arsenic, cyanide, chromium and cadmium, may be removed by chemical polymerization and precipitation, with subsequent gravity settling and filtration. Heavy metals may be removed by ion exchange or softening processes. Iron and managanese, which cause turbidity, have been oxidized successfully with ozone. While the water industry has the basic tools to develop better technology, additional research is urged. (Kramer-FIRL)

HYGIENIC EVALUATION OF CHLORINATING WATER BY PRODUCTS OF THE ELECTROLY-SIS OF SODIUM CHLORIDE SOLUTIONS, (IN

RUSSIAN), V. A. Slipchenko, E. I. Saigak, and A. D. Kharchenko. Gig Sanit. 11. 90-91. 1974.

Descriptors: Public health, \*Electrolysis, \*Chlorination, Potable water, \*Water treatment, Chlorides. Identifiers: \*Eltrolytic chlorination.

Electrolytic chlorination is suitable for treating drinking water with the use of flowthrough electrolyzers having Ti-Pt electrodes at a current strength up to 4000 A/m2, solution concentration up to 50 gl and temperature of the outgoing solution up to 50 degrees.—Copyright 1975, Biological Abstracts, Inc. W76-03813

THE CONSTRUCTION AND OPERATION OF GRAVEL WELL SOURCES WITH PARTICU-LAR REFERENCE TO THOSE OF THE NENE AND OUSE WATER BOARD,

For primary bibliographic entry see Field 3B. W76-03817

PVC PIPE IN WATER DISTRIBUTION: RELIA-BILITY AND DURABILITY,

Petrochemicals Co., Inc., Fort Worth, Tex. W. D. Nesbeitt.

American Water Works Association Journal, Vol 67, No 10, p 576-581, October, 1975. 7 fig, 1 tab, 14

Descriptors: \*Pipelines, \*Plastics, \*Pipes, \*Water distribution(Applied), Construction materials, Water treatment, Water supply, Costs, Regression analysis, Joints(Connections). Identifiers: \*Polyvinyl chloride(PVC) pipe.

The benefits and limitations of polyvinyl chloride The benefits and limitations of polyvinyl chloride (PVC) pipes from water utilities are outlined. The properties of PVC pipe that provide reliability and durability in water distribution systems are outlined. Costs benefits, such as flow capacity, strength-to-weight ratio, ease of handling, and joining technology are discussed. Because PVC is nonbiodegradable, it is not susceptible to the attack of bacteria or other microorganisms. However, PVC should not be exposed to heavy soft ever, PVC should not be exposed to heavy solvents and aromatics, and it may be affected by exposure to ultraviolet rays. PVC has the advantage of dielectric strength; it will not convey electric current and is not susceptible to electrolytic corrosion (as is metal piping). PVC pipe is flexible, giving it an advantage when it must be laid through unstable or heavy soils. PVC is a thermoplastic material, and allowances must be made in design and installation for expansion and contraction if and installation for expansion and contraction if pipeline will provide service over a wide range of temperatures. Safety factors for PVC and for traditional piping materials were compared. While plastic pipe can withstand short-term pressure surges, stresses and pressure ratings must be figured into pipeline design. Stress regression (SR) curves are presented and detailed. PVC, however, if subjected to a long-term history of cyclic pressure surges, may display failure, similar to that displayed in traditional piping materials. It was suggested that municipal water distribution systems should carefully consider the benefits as well as limitations in evaluating the use of polyvinyl chloride material for pipelines. (Kramer-FIRL) W76-03830 and installation for expansion and contraction if

### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5F-Water Treatment and Quality Alteration

ORGANICS IN DRINKING WATER, PART I-LISTING OF IDENTIFIED CHEMICALS,

Ames Lab., Iowa. For primary bibliographic entry see Field 5A. W76-03850

**ENVIRONMENTAL LAW--1974 STYLE** For primary bibliographic entry see Field 5G.

CRAWFORD V. STATE (LACK OF FLOURIDA-TION OF WATER NO BASIS FOR WITHHOLD-ING PERMIT FOR WATER WORKS INSTAL-

For primary bibliographic entry see Field 6E. W76-03943

### 5G. Water Quality Control

ENVIRONMENTAL MANAGEMENT FOR THE METROPOLITAN AREA-WATER QUALITY,

Stevens, Thompson and Runyan, Inc., Seattle, Wash.

Prepared for Environmental Protection Agency and Municipality of Metropolitan Seattle, Washington, November, 1974. 283 p, 51 fig, 69 tab, photos. IGA-00037.

Descriptors: \*Environmental control, \*Water quality control, \*Planning, \*Water pollution con-trol, \*Water management(Applied), Water quality, \*Non-structural alternatives, \*Sewerage, Environmental effects, Water quality standards, Law enforcement, \*Washington, Sewage treatment.
Identifiers: Environmental management,
Seattle(Wash), Cedar River(Wash), Green
River(Wash), \*River Basin Coordinating Committee(RIBCO).

The water quality management study, which began in 1971, defined a basin-wide water quality management program in Cedar and Green River Basins as part of a total environmental planning effort conducted by the River Basin Coordinating Committee (RIBCO). This report is intended to provide decision-makers with the basic tools and information needed to maintain and enhance water quality from both a regional and local standpoint. Existing water quality conditions of each in-dividual water body are analyzed, factors affecting the water quality including point and non-point sources are identified, and a spectrum of water quality management alternatives are proposed. The water quality was found to be of high standard although changes can be expected from non-point wastes. A monitoring program coupled with water management studies for individual small drainages would allow corrective measures to be tailored to local conditions and needs. Other alternatives outlined include more stringent laws and guidelines, a regional sewerage plan and a dynamic management system that anticipates and identifies defi-ciencies in water quality and then systematically records responses of water quality to changes in land use, assesses the impacts, formulates alternatives and selects an appropriate implementation strategy. (Salzman-North Carolina) W76-03501

# SEPARATION OF EMULSIFIED LIQUIDS,

(Assignee). I. P. Mail.

U S Patent No 3,919,081, 4 p, 2 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 940, No 2, p 890, November 11, 1975.

Descriptors: \*Patents, \*Oil pollution, Water pollu-tion, \*Oily water, \*Water pollution control, \*Water quality control, \*Separation techniques, Emulsions, Activated carbon. Identifiers: Agglomeration.

The separation of insoluble liquid hydrocarbons and water which are bound together in an emulsion the dominant phase is the water, is described. A bed of activated carbon is installed in a tank and the activated carbon is washed with acid to remove alkaline ash. Then the bed is saturated or wetted with insoluble hydrocarbons where it clings to the media to form passages through the bed with the insoluble hydrocarbons as their walls. The emulsion is passed through the bed by gravity to agglomerate the insoluble liquid hydrocarbons in the mixture into droplets large enough to readily coalesce into a body. The water and insoluble liquid hydrocarbons are collected and discharged separately. (Sinha-OEIS) W76-03507

#### TREATMENT OF FLOATING POLLUTANTS. Loctite (Ireland) Ltd, Dublin. (Assignee).

D.J. O'Sullivan, and B. J. Bolger.
U S Patent No 3,919,083, 4 p, 9 ref; Official Gazette of the United States Patent Office, Vol 940, No 2, p 890, November 11, 1975.

Descriptors: "Patents, "Water pollution treatment, 
"Oil pollution, "Inorganic compounds, "Oil spills, 
Water pollution, Water pollution control, Water 
quality control, Chemical reactions, Polymers. 
Identifiers: 2-cyanoacrylic acid.

Compositions and processes for the treatment of oil slick and other floating water-borne pollutants of water expanses and their margins is described. A chemical treatment of such pollutants incor-porates them in a solid, semi-solid, reticulate or honeycomb-like mass or matrix, and reduces or destroys their propensity to cling to objects with which they come in contact. A composition containing at least one substance which polymerizes to a matrix with incorporation of at least a portion of the pollution is applied. The composition used in the process commonly are those containing polymerizable esters of 2-cyanoacrylic acid. These esters can comprise the total of the composition. but other ingredients may be incorporated. The most convenient method of application is by spraying, such as from a pressurized cylinder conthe composition. The composite mass which is formed may float or sink depending on its density relative to that of the fresh or salt water. If it floats, as is frequently preferred, it may be swept or raked up mechanically and disposed of. If it sinks, the preponderance of the pollution threat is also removed. In either case, the pollution threat is also removed. In either case, the pollutant is incorporated and enclosed in a chemically and physically innocuous form. (Sinha-OEIS) W76-03508

FLOATING ANTI-POLLUTION BARRIER,
Pneumatiques, Caoutchouc Manufacture et
Plastiques Kleber-Colombes (France). (Assignee).

U S Patent No 3,919,847, 4 p, 6 fig, 16 ref; Official Gazette of the United States Patent Office, Vol 940, No 3, p 1145, November 18, 1975.

Descriptors: \*Patents, \*Water pollution control, \*Pollution abatement, Oil pollution, Flotsam, Jet-sam, \*Barriers, Floating, \*Separation techniques.

A floating antipollution barrier used to catch floating articles or substances consist of one or more floating elements and a skirt made of flexible material such as a fabric impregnated with rubber or a similar material. The barriers comprise a skirt which is supported by a floating element which ex-tends over the entire length of the skirt but which consists of a series of sealed compartments made of a flexible fabric. These compartments do not communicate with each other and are interconnected by means of strips of fabric, the width of which is between 5 and 20% of the distance separating two consecutive strips. The barries are produced by constructing entirely each of the closed sealed compartments and then by joining the strips so as to interlink the different compart-

ments and simultaneously to ensure sealing between these different compartments. The combetween these different compartments. The compartments are closed containers. They may be inflated with air but this necessitates an inflation operation per compartment and thus a fairly long period of time to prepare the barrier. Thus, it is often preferable to place inside these compartments a substance or mechanical elements such as a ring, which gives them a shap and keeps this shape so that the volume of water which they displace is sufficient to ensure adequate floatability. (Sinha-OEIS) W76-03513

#### DEALING WITH OIL SPILLAGE CONTAMINA-TION,

National Water Well Association, Worthington, Ohio. T. E. Gass.

Water Well Journal, Vol 29, No 10, p 32-33, November 1975.

Descriptors: \*Oily water, \*Water pollution treatment, Soil contamination, \*Oil spillage, Oil pollution, Water wells.

Identifiers: Charcoal filtration, Imbiber beads, Well water.

Numerous reports of well water contamination due to oil contamination are recorded each year. Many of these cases are due to minor spills in close proximity to the wells. A number of methods are described by which the well water or aquifer can be purified. Methods include: pumping the well to waste, charcoal filtration, installation of Imbiber Beads, removal of contaminated soil, and installation of a new well. (Gass-NWWA) W76-03522

#### FEED AND FIBER FROM EFFLUENT-GROWN WATER HYACINTH,

Florida Univ., Gainesville. Dept. of Agricultural Engineering. For primary W76-03551 bibliographic entry see Field 5D.

### AQUACULTURE AS A MEANS TO ACHIEVE

EFFLUENT STANDARDS,
Oklahoma State Dept. of Health, Oklahoma City.
Water Quality Monitoring and Research Div.
For primary bibliographic entry see Field 5D.
W76-03554

SOCIAL, POLITICAL, REGULATORY AND MARKETING PROBLEMS OF MARINE WASTE-FOOD RECYCLING SYSTEMS, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 6B. W76-03563

THE MICHIGAN STATE UNIVERSITY WATER QUALITY MANAGEMENT PROGRAM, Michigan State Univ., East Lansing. Inst. of Water Research.

For primary bibliographic entry see Field 5D. W76-03565

POLYCULTURAL WASTEWATER RECLAMA-TION AT CALIFORNIA POLYTECHNIC STATE UNIVERSITY--AN ACADEMIC INSTRUC-TIONAL SYSTEM,

California Polytechnic State Univ., San Luis Obispo. Dept. of Biological Sciences. For primary bibliographic entry see Field 5D. W76-03567

THE DIALECTICS OF A PROPOSAL ON BIOLOGICAL CONTROL OF EUTROPHICATION IN SEWAGE LAGOONS, National Taiwan Univ., Taipei. For primary bibliographic entry see Field 5C.

W76-03570

### WATER QUALITY MANAGEMENT AND PROTECTION-Field 5 Water Quality Control—Group 5G

THE HARVESTING OF ALGAE AS A FOOD SOURCE FROM WASTEWATER USING NATU-RAL AND TECHNIQUES, INDUCED FLOCCULATION

Louisville Univ., Ky.

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For primary bibliographic entry see Field 5D. W76-03571

A PROGRESS REPORT ON THE INTERNA-TIONAL CONVENTION ON CIVIL LIABILITY FOR OIL POLLUTION DAMAGE AND ITS SUP-PLEMENTARY FUND CONVENTION, Office of the Judge Advocate General (Navy), Washington, D. C.

L. D. Wood.

Environmental Law Reporter, Vol 5, No 6, p 50103-50107 (June 1975). 5 p, 66 ref.

Descriptors: \*Oil spills, Ships, \*International law, \*United Nations, Accidents, Oil industry, Treaties, Political aspects, International waters, United States, Costs, International waters, United States, Costs, International, Joint commission, Foreign countries, Cleaning, Oily water, Oil pollu-tion, Jurisdiction, Adoption of practices, Water pollution control, Legal aspects, Environmental effects.

Identifiers: Liability Convention, Fund convention, \*Oil tankers, \*Torrey Canyon disaster, \*Liability, Intergovernmental Maritime Consultative Organization(IMCO), Grounding, Oil cleanup, Strict liability, Hazardous substances(Pollution),

International agreements.

The International Convention on Civil Liability for Oil Pollution Damage has been ratified by the requisite number of nations to activate that treaty. It is suggested that a supplementary agreement, the Fund Convention, will be forthcoming. Both conventions arose out of United Nations concern for the problems and questions raised by the Tor-rey Canyon disaster of 1967, where a small oil tanker polluted the shores of Great Britain and France. Massive cleanup expenses were incurred with no adequate mechanism for reimbursement. The Liability Convention basically provides strict liability for oil spills. Judgements rendered by the courts of one contracting nation can be enforced in any other contracting nation. The Fund Convention is designed to establish a large compensation fund financed by a levy on oil imported by sea to contracting nations. Contracting nations agree to recognize the Fund as a legal entity which can sue and be sued in the courts. Since the Liability and Fund Conventions will establish the basic international law on oil pollution liability, early ratifica-tion by the United States is urged to promote inter-national acceptance of the treaties. (Parrish-Florida) W76-03584

THE FEDERAL WATER POLLUTION CONTROL ACT AND FORESTRY,

National Forest Products Association, Washington, D.C. Environmental Quality Dept.

B. C. Grefrath. Journal of Forestry, Vol 72, No 12, p 757-759 (December 1974). 3 p, 10 ref.

Descriptors: \*Water pollution control, \*Federal Water Pollution Control Act, \*Forestry, \*Administrative agencies, Navigable waters, Federal government, State governments, Pollution, Forest management, Forest watersheds, Pollution abatement, Permits, Navigation, Wildlife, Swimming, Fishing, Recreation, Agriculture, Effluents, Sediments, Adoption of practices, Administration, Water quality, Industries, Watershed ministration, Water quality, Industries, Watershed management.

Identifiers: \*Non-point source(Pollution), National Pollutant Discharge Elimin System(NPDES), Administrative regulations. Elimination

This article surveys the effects of the Federal Water Pollution Control Act (FWPCA) of 1972 on forestry, over the past two year period. Under the act, states are assigned primary responsibilities for

water pollution control and enforcement, with the Environmental Protection Agency (EPA) as administering agent. Under the Act, pollution point sources such as paper mills and sawmills must comply with effluent limitations on the discharge of pollutants into waterways. Control of non-point sources falls under water quality standards that are set by the states and approved by the EPA. The goal set by Congress is that by 1983, all waters will support fishing and swimming where possible. With regard to forestry, this means the states may require forest landowners to comply by regulating forest practices either indirectly, through water control standards, and requiring owners and operators to adjust or discontinue forest practices; or directly, through established performance standards for timber harvesting, chemical application, road construction, and other field operations. Further, the forestry profession, has a responsibility in developing water pollution control programs that comply with the FWPCA. (Parrish-Florida) W76-03586

A SUGGESTED STATE FOREST PRACTICES ACT (MECHANISM FOR IMPROVING WATER QUALITY ON FOREST LANDS),

Environmental Protection Agency, Washington, D. C

J. L. Agee.

Journal of Forestry, Vol 73, No 1, p 40-41, (January 1975). 2 p, 2 ref.

Descriptors: \*Water pollution control, \*Federal Water Pollution Control Act, \*Forestry, \*Administrative agencies, Navigable waters, Federal government, State government, Forest management, Forests, Forest watersheds, Pollution abatement, Industries, Effluents, Adoption of practices, Water quality, Sawmills, Pollutants.
Identifiers: Suggested State Forest Practices Act,
\*Non-point \_sources(Pollution), Administrative regulations, Effluent limitations.

Under the 1972 Amendments to the Federal Water Pollution Control Act, the Environmental Protec-tion Agency (EPA) has become increasingly in-volved in the area of forest management. Originally, EPA focused primarily on pollution from pulp mills and fiberboard processing plants; but recognition that non-point source pollution will emerge as the major barrier to achievement of the act's 1983 goals has led to several EPA reports on methods for evaluating non-point sources. Other EPA studies have resulted in a logging road construction manual, a manual of forest chemical use, and a harvesting manual. The initial draft of the 'Suggested State Forest Practices Act' reflects EPA's recognition that an enormous variety of conditions, including land ownership, topography, soil type and climate will affect a state's need for legislation and the form such legislation should take. The suggested act requires approval of all forest management plans and places the burden of proof on the potential polluter to show that reasonable steps are being taken to prevent pollution. (Parrish-Florida)

HOW NOW BROWN COW: REGULATION OF FEEDLOT POLLUTION IN WISCONSIN, Harvard Law School, Cambridge, Mass.

C. E. Blackwell. III. Environmental Affairs, Vol 3, No 4, p 769-792 (1974). 24 p, 4 tab, 83 ref.

Descriptors: \*Feed lots, \*Farm wastes, \*Wisconsin, \*Eutrophication, \*Rainfall-runoff relationships, Sodium, Magnesium, Public health, Recreation, Phosphorus, Nitrogen, Agriculture, Farm management, Livestock, Fertilizers, Dis-eases, Runoff, Rainfall, Rivers, Lakes, Rivers and Harbors Act, Federal Water Pollution Control Act, Water pollution control, State governments, Federal governments.

Identifiers: \*Non-point sources(Pollution), \*Federal Water Pollution Control Act Amend-ments of 1972, Refuse Act, Point source(Pollution), Effluent limitations.

Runoff from animal feedlots is a major non-point source of pollution. While the exact meaning va-ries, feedlot in this article is defined as any concentrated animal feeding operations for raising and holding cattle, hogs, sheep and poultry. In time of heavy rain, the runoff from such feedlots is likely to be high in nitrogen, phosphorus, magnesium, potassium and sodium. These chemicals accelerate the eutrophication process in rivers and lakes. The problem is particularly bad in Wisconsin where a growing water recreation industry is in direct con-flict with strong agricultural interests. Under the Federal Water Pollution Control Act Amendments Federal Water Pollution Control Act Amendments of 1972, feedlots have been designated a point source of pollution. However, the Environmental Protection Agency (EPA), which had been granted authority to administer the 'clean up' program, has attempted to abrogate the effectiveness of the Act, attempted to abrogate the effectiveness of the Act, reputedly because the policing of greater numbers of small feedlots would create unacceptable manpower demands on the Agency. The problem of feedlot pollution, therefore, is still largely unsolved. (Parrish-Florida)

UNITED STATES ENVIRONMENTAL LAWS AND EXPLORATION AND PRODUCTION OPERATIONS,

Atlantic Richfield Co., Dallas, Tex. North Amer-

ican Producing Div.

Alberta Law Rev, Vol 13, No 1, p 1-17 (1975), 17 p. 80 ref

Descriptors: \*Oil industry, \*Environmental effects, \*Rivers and Harbors Act, \*Water Quality Act, \*Federal Water Pollution Control Act, Legal constraints, Oil pollution, Regulation, Permits, Oil wells, Federal governments, State governments, Jurisdiction, Water pollution, Oil spills, Oil fields, Regulation, Environmental control. Identifiers: \*1972 FWPCA Amendments, Licenses, National Environmental Protection Act, Oil

Pollution Act, Environmental impact statements,

Environmental policy.

To help assure adequate protection of the environment, numerous statutes have been enacted to provide regulation of the oil and gas industry. To provide a background for discussing modern legislation, a brief overview of the evolution of environmental legislation is presented showing that some degree of environmental control has been in existence since the early 1900's. Due to a tremendous upsurge in environmental awareness, how-ever, the great proportion of current environmen-tal laws and regulations have enacted in the last decade. To illustrate the degree of this regulation, the author describes the Acts and regulations which must be complied with today in order to get a permit to explore for oil or gas, Special attention is given to the provision in the National Environ-mental Policy Act that requires that an environ-mental impact statement be issued for every major federal action significantly affecting the quality of the human environment. Also emphasized is the impact that water quality legislation, such as the Federal Water Pollution Control Act and the National Pollutant Discharge Elimination System, has had on the oil and gas industry. (Hoffman-Florida) W76-03592

A NEW APPROACH TO INTERNATIONAL EN-VIRONMENTAL COOPERATION; THE NATO COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY,

Environmental Protection Agency, Washington, D. C

Kansas Law Review, Vol 22, No 2, p 167-191 (1974). 25 p, 92 ref.

### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G-Water Quality Control

interrelations, Descriptors: \*Governmental \*Organizations, \*Information exchange, \*International commissions, \*Political aspects, Legal aspects, Water, Water law, United States, Water pollution, Water pollution control, Bodies of water, Institutions, Planning, Water policy, International waters, Future planning(Projected), Environment, Technology.

Identifiers: \*NATO, Committee on the Challenges of Modern Society(CCMS), International agreements, Coastal waters, Inland waters.

International cooperation in the environmental area falls into two categories: international stan-dard setting; and exchange of technology, knowledge, and experience. The second category presents the most problems. The main shortcoming of efforts in this area has been the failure to make the information exchanged a factor in domestic policy making. International cooperation in the exchange of technology and scientific data currently takes place on global, regional, and bi-lateral levels. However, many of these efforts have accomplished little beyond providing for exchange of information. In 1969, the need for a new, more flexible and action-oriented approach to multinational environmental cooperation resulted in the creation of the North Atlantic Treaty Organization Committee on the Challenges of Modern Society (CCMS). CCMS has un-dertaken pilot studies in sveral areas. The final report on a study of inland water pollution is currently in the drafting stage, while a study of coastal water pollution has resulted in various NATO resolutions. (Schilling-Florida) W76-03594

#### TECHNOLOGY FOR MANAGING SPILLS ON LAND AND WATER,

Calspan Corp., Buffalo, N. Y.

D. B. Dahm, and R. J. Pilie.
Environment Science and Technology, Vol 8, No 13, p 1076-1079, (December 1974). 4 p, 3 photo, 5 tab. 5 ref.

Descriptors: \*Phenols, \*Control, \*Seepage control, \*Research and development, \*Chemicals, Water quality control, Water pollution control, Multiple-purpose projects, Projects, Technology, Water pollution sources.

Identifiers: Hazardous materials, Spill technology, Sulfuric acid.

The U. S. Environmental Protection Agency (EPA), Office of Research and Monitoring, has initiated intensive research and development programs in hazardous material spill control technology. Some of the hazardous materials involved include sulfuric acid, phenol, and acrylonitrile. Until recently the attitude toward these spills has been that little can be done except to evacuate the area. The EPA's research program, however, has discovered several promising control methods such as: foam-in-place plugs to stop the flow from leakage containers, foam-in-place dams to prevent the flow of a spilled material from reaching a watercourse, a physical-chemical treatment unit to treat hazardous material spills confined in a watercourse, and floatable, activated carbon or ionexchange resins to treat spill in a flowing stream. Statistics and detailed information on these control methods are given. Tables are set forth which rank hazardous compounds by annual production quantity, ranking soluble hazardous substances by production and toxicity, and reporting typical hazardous spills in 1973. There is also a discussion of the problems involved in the protection of personnel dealing with these hazardous materials. (Hoffman-Florida) W76-03595

WPCF LOOKS AT WAT PROBLEMS AND PROSPECTS. WATER CLEANUP

Environmental Science and Technology, Vol 8, No 13, p 1073 (December 1974). 1 p, 2 photo.

Descriptors: \*Federal Water Pollution Control Act, \*Management, \*Economic efficiency, \*Financing, Economics, Water pollution control, Environmental effects, Planning, Administration, Project post-evaluation, Water policy, Federal government, Decision making, Standards, Water pollution, Government finance, Sludge, Carbon. Identifiers: Monitoring systems.

John Parkhurst, president of the Water Pollution Control Federation, told the WPCF's annual con-ference that the Federal Water Pollution Control Act Amendments of 1972 are not suitable for implementation. Parkhurst argued that the uniform national standards required by the amendments defeat the purpose of attaining cost effective water pollution control. He expressed doubt that even the Federal Government could finance systems necessary to comply fully with the Act.

Another complaint was that all major aspects of
water pollution control must be directed at the federal level, and that the law is so explicit that it leaves little room for administrative judgement. In addition to Parkhurst's speech, there were several company press conferences at the WPCF convention. Air Products and Chemicals, Inc., discussed the increasing use of its oxygen activated sludge environmental systems. Envirotech Corp. an-nounced its new DC-60 total organic carbon moni-tor while Philips Electronic Instruments, Inc., described its new line of automatic water monitoring stations that measure numerous parameters. (Hoffman-Florida) W76-03596

### NEW CLASSIFICATIONS ADOPTED AND ASSIGNED TO CERTAIN WATERS IN THE YAD-KIN RIVER BASIN.

North Carolina Environmental Management Commission. Raleigh.

Descriptors: \*Classification, \*Water \*Water allocation(Policy), \*Water supply develop-ment. \*Municipal water, \*North Carolina, State governments, Conservation, Streams, Water treatment, Water conservation, Water distribu-tion(Applied), Water demand, Dams, Water quality, Boating, Diversion dams, Diversion, Protec-

Identifiers: Public hearings, Creeks, \*Yaakin River basin(NC).

This report contains the proceedings of a public Inis report contains the proceedings of a public hearing held by the Water and Air Quality Control Committee of the Environmental Management Commission relative to an application filed by the town of Yadkinville, North Carolina. The application requested the reclassification of South Deep Creek and its tributaries from that of use for fishing and boating (Class 'C') to that of use as a public water supply (Class 'A-11'). Testimony given by various local water authorities indicated that Yadkinville needs a high quantity, high quality source of water, and that the waters of South Deep Creek would fill that need. Reclassification of the Creek would allow Yadkinville to proceed with its plan to construct a diversion dam to withdraw water for treatment at a plant near the dam site with a capacity of 1.83 million gallons per day. Since there was no opposition to upgrading the classification, the Committee recommended its approval. (Parrish-Florida) . W76-03598

#### STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY--PROPOSED EF-FLUENT LIMITATIONS GUIDELINES AND STANDARDS.

Environmental Protection Agency, Washington, Federal Register, Vol 39, No 43, Part III, p 8294-8307, March 4, 1974. 14 p.

\*Administrative Effluents Descriptors: \*Water quality standards, \*Administrative agencies, \*Regulation, \*Effluents, \*Steam, \*Thermal pollution, Thermal power, Thermal powerplants, Standards, Water pollution, Treatment, Water treatment, Waste treatment, Federal Government, Wastes, Water pollution sources, Electric power, Heated water, Water cooling, Sewage effluents, Discharge(Water), Industrial wastes, Waste water(Pollution), Waste water disposal. Identifiers: Administrative regulations, Effluent limitations, Pretreatment standards(Effluent), Federal Water Pollution Control Act(FWPCA), Amendments of 1972, Hazardous sub-Amendments of stances(Pollution).

Notice is hereby given of proposed effluent limita-tions guidelines for existing sources and standards of performance and pretreatment standards for new sources in the steam electric power generating category, pursuant to the Federal Water Pollution Control Act (FWPCA), as amended. Thermal (waste heat) control and treatment technologies are of two general types; those which are designed to reduce the quantities of waste heat rejected from the process in relation to the quantities of electrical energy generated and those which are designed to eliminate to some degree the reliance upon a navigable water body as a step toward ulti-mate transfer of the rejected heat to and beyond the atmosphere. Effluent limitations correspond-ing to the best practicable control technology currently available are no discharge of heat except for cold-side blowdown for all large base-load units. Mechanical draft evaporatine cooling towers provide the basis for evaluation of costs, effluent reduction benefits, and other factors. Limitations attainable under the best available technology economically achievable requires cold-side blowdown and closed-cycle evaporatine cooling systems. (Fernandez-Florida)

W76-03601

### MEAT PRODUCTS POINT SOURCE CATEGO-RY--SMALL PROCESSOR SUBCATEGORY; EF-FLUENT LIMITATIONS AND GUIDELINES.

Environmental Protection Agency, Washington,

Federal Register, Vol 39, No 168, p 31485-31497, August 28, 1974. 13 p.

Descriptors: \*Water quality standards, \*Environmental effects, \*Administrative agencies, \*Water pollution, \*Food processing industry, Industries, Legal aspects, Water law, Regulation, Federal government, Technology, Economic impact Water pollution control, Water pollution pact, Water pollution control, Water pollution treatment, Water quality control, Pollutants, Ef-fluents, Water pollution sources, Nitrites, Water. Identifiers: \*Federal Water Pollution Control Act Amendments of 1972, Administrative regulations, Effluent limitations.

The Environmental Protection Agency hereby proposes effluent limitations and guidelines for existing sources and standards of performance and isting sources and standards of performance and pretreatment standards for new sources for the meat products point source category. The proposed regulation will amend present regulations by adding a small processor subcategory, meat cutter category, sausage and luncheon meat processor subcategory, ham processor subcategory, canned meat processor subcategory and the renderer subcategory. The regulation requires that existing point sources achieve effluent limitations which represent the best practible control technology currently available by July 1, 1977. It also requires the achievement, by not later than July 1, 1983, of effluent limitations which include July 1, 1983, or effluent immatations which include the best available, economically achievable, technology which will result in reasonable progress toward the national goal of eliminating the discharge of all pollutants. New point sources must achieve a Federal standard of performance which reflects the greatest degree of effluent reduction achievable through the best available control technology, including a standard permitting no discharge of pollutants, when practica-ble. (Nursery-Florida) W76-03602

MEAT PRODUCTS AND RENDERING PROCESSING POINT SOURCE CATEGORY-EFFLUENT GUIDELINES AND STANDARDS. Environmental Protection Agency, Washington, D.C.

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Federal Register, Vol 40, No 2, Part II, p 901-914, January 3, 1975, 14p.

Descriptors: \*Industraial wastes, Effluents, \*Water pollution control, Discharge(Water), Sewage effluents, Liquid wastes, Waste water disposal, Standards, \*Water quality standards, Regulation, Penalties(Legal), Technology, Economic impact, Economic justification, Water, Water law, Legal aspects, Environmental effects. Identifiers: \*Meat processing plants, \*Effluent guidelines, Effluent limitations, Hazardous substances(Pollution).

These regulation establish final effluent limitations guidelines for existing sources and standards of performance and pretreatment standards for new sources in the meat product and rendering processing category of point sources. The regulations concern six new subcategories which include: small processor; meat cutter; sausage and luncheon meat processor; ham processor; canned meat processor; and renderer. No adverse economic impact is foreseen as a result of these new requirements. Implementation of these effluent limitations guidelines should substantially reduce the environmental harm which would otherwise be attributable to the continued discharge of polluted waste waters from existing and newly constructed plants. Preceding the regulations is a summary of the significant comments received by the Environmental Protection Agency concerning the initial proposed regulations and the Agency's response to them. The new subcategories are delineated in terms of applicability and description of the subcategory; effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available; effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best available technology economically achievable; standards of performance for new sources; and pretreatment standards for new sources. (Hoffman-Florida)

GRAIN MILLS MANUFACTURING POINT SOURCE CATEGORY--EFFLUENT LIMITA-TIONS AND GUIDELINES. Environmental Protection Agency, Washington,

D.C. Federal Register, Vol 40, No 2, Part III, p 915-922, January 3, 1975. 8 p.

Descriptors: \*Industrial wastes, \*Water quality standards, \*Sewage disposal, \*Waste water disposal, Regulation, Technology, Economic impact, Effluents, Water quality control, Sewage effluents, Discharge(Water), Liquid wastes, Federal jurisdiction, Water pollution treatment, Water purification, Water, Water law, Legal aspects, Environmental effects.

vironmental effects.
Identifiers: \*Grain mills, Effluent guidelines,
\*Effluent limitations.

These regulations establish final effluent limitations and guidelines for existing sources and standards of performance and pretreatment standards for new sources in the grain mills manufacturing category of point sources. The regulations concern four new subcategories: animal feed, hot cereal; ready-to-eat cereal; and wheat starch and gluten Analysis indicates that the economic impact of the guidelines is minimal. No plant closures are anticipated if current practices are continued. The implementation of the guidelines should substantially reduce the environmental harm which would otherwise be attributable to the continued discharge of polluted waste waters from existing and newly constructed plants in the grain mills manufacturing industry. Various sections under

the four subcategories include: description and applicability of the subcategory; specialized definition; effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practical control technology currently available; effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best available technology economically achievable; standards of performance for new sources; and pretreatment standards for new sources. (Hoffman-Florida)

INTERVENTION ON THE HIGH SEAS ACT. For primary bibliographic entry see Field 6E. W76-03606

UNITED STATES V. SMITH (DREDGING AND FILLING MARSHLAND WITHOUT CORPS OF ENGINEERS PERMIT).
For primary bibliographic entry see Field 6E. W76.03607.

PEOPLE OF CALIFORNIA EX REL. STATE WATER RESOURCES CONTROL BOARD V. ENVIRONMENTAL PROTECTION AGENCY (ACTION TO REQUIRE EPA TO NOT EXEMPT FEDERAL AGENCIES FROM PERMIT PROGRAMS).

For primary bibliographic entry see Field 6E. W76-03610

SPRINGER V. JOSEPH SCHLITZ BREWING COMPANY (DIVERSITY ACTION BY OWNERS OF DOWNSTREAM FARM ALLEGING DISCHARGE INTO MUNICIPAL TREATMENT FACILITY WHICH CAUSED OVERLOAD AND POLLUTION).

For primary bibliographic entry see Field 6E. W76-03611

NATURAL RESOURCES DEFENSE COUNCIL, INC. V. TRAIN (ACTION BY ENVIRONMENTAL GROUP TO COMPEL PUBLICATION OF EFFLUENT GUIDELINES BY THE ENVIRONMENTAL PROTECTION AGENCY). For primary bibliographic entry see Field 6E. W76-03612

DEPARTMENT OF NATURAL RESOURCES V. LINCHESTER SAND AND GRAVEL CORP (APPEAL BY LANDOWNER FROM DENIAL OF PERMIT TO DREDGE AND FILL PRIVATE WETLANDS).

For primary bibliographic entry see Field 6E. W76-03617

HOLIDAY INNS, INC. V. POLLUTION CONTROL BOARD (PETITION FOR REVIEW OF ORDER DENYING VARIANCE FROM WATER POLLUTION RELATIONS REGARDING EFFLUENT).

For primary bibliographic entry see Field 6E. W76-03618

REPORT ON WASTEWATER SERVICE CHARGES, METROPOLITAN SEWERAGE DIS-TRICT, BUNCOMBE COUNTY, NORTH CAROLINA.

Greeley and Hansen, Chicago, Ill.
Prepared for Metropolitan Sewerage District,
Buncombe County, N.C., February, 1975 (Rev.).
46 p. 2 fig. 13 tab, 2 append.

Descriptors: \*Pollution charges(Taxes), \*Pricing, \*Cost analysis, \*Adjusted prices, Grants, Waste water, Wastes, Suspended solids, Biochemical oxygen demand, Waste water treatment, \*North Carolina.

Identifiers: Buncombe County(NC), Asheville(NC), French Broad River(NC), Swannanoa River(NC), Weaverville(NC), Reems Creek(NC), Cane Creek(NC), Wastewater volumes, Wastewater strength.

There are 21 major industrial contributors and 25,760 domestic customers (residential users, all commercial and institutional users with small commercial and institutional users with small volume discharges and no significant strength characteristics) to the wastewater disposal system in the Asheville Metropolitan Area. Adjustments to service charges are now required due to the need for continuous chlorination of the effluent. the increased cost of power, and inflation. The objective of this study is the development of a schedule of charges resulting in industry assuming its reasonable share of the total annual costs. Specifically, the new formula for determining user charge is based on: (1) unit costs related to quantity, to biochemical oxygen demand, and to suspended solids and (2) the users' actual con-tributions to the wastewater volume and these waste strength parameters. Design of the total system assumes an approximate annual average flow of 25.5 mgd, 38,850 pounds per day BOD, and 48,350 lbs/day suspended solids. Proposed unit charges for domestic users based on costs during fiscal year 1975-1976 are \$.32 per 100 cubic feet of wastewater. Proposed industry charges are \$.097
per 100 cf of wastewater, \$.051 per lb of BOD, and
\$.025 per lb of SS by 1977-78. Federal guidelines
provide for the recovery of that portion of the Federal grant allocated to the conveyance and treatment of the wastes from each industrial user. Grant recovery is to be based on allocation of the grant to functions and the annual discharge of waste volume and lbs of BOD and SS. These recovery charges are to be billed to the appropriate industries at the end of each year. (Henley-North W76-03628

HANLON CREEK ECOLOGICAL STUDY, PHASE A.

Guelph Univ. (Ontario). Centre for Resources Development.

Prepared for Hanlon Expressway Technical Advisory Committee, Guelph, Ontario. Publication No 50, September, 1971. 66 p, 12 fig, 9 tab, append.

Descriptors: \*Cover crops, \*Water pollution control, \*Erosion control, \*Road banks, \*Environmental effects, \*Highway effects, \*Water quality control, Planning, Land use, Nonstructural alternatives, Sediment control, Water management(Applied), \*Canada.

Identifiers: Hanlon Creek(Ontario Canada).

The existing micro-drainage system, including the biological and physical characteristics, of the Hanon Expressway Corridor in the vicinity of Hanlon Creek is inventoried and analyzed in relationship to the effect of proposed expressway works. Detailed plans for the Expressway are examined to identify aspects of the project which result in adverse modification to existing natural life systems. This report attempts to identify techniques for the management of Hanlon Creek and vicinity which will allow the continuation of an environment capable of supporting at least the existing levels of aquatic and terrestrial life. Assuming that good planning attempts to allow a broad spectrum of alternatives, recommendations include both construction and post-construction phases: erosion control, installation of sediment ponds, minimization of destruction of existing vegetation, protection of exposed soil surfaces with cover plants, replanting program using more salt-tolerant plants to withstand salt deicing programs, frequent inspection and repair of drainage works. An environmental monitoring system should be established within the watershed to obtain data needed for establishment of design criteria. To develop an effective environmental management program, research into alternative

### Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G-Water Quality Control

techniques, e.g. erosion control measures, pollutant sensitivity monitors and design standards, should be intensified. (Salzman-North Carolina)

OKANAGAN WATER DECISIONS

Simon Fraser Univ. Burnaby (British Columbia). Dept. of Geography.
T. O'Riordan, and J. O'Riordan

Western Geographical Series, Vol 4, H. D. Foster, ed. University of Victoria, 1972. 158 p, 9 fig, 11 plates, 21 tab, 213 ref.

Descriptors: \*Water management(Applied), \*Political constraints, \*Political aspects, Project planning, Local problems, Cost-benefit analysis, \*Canada, Nutrients, Limnology, Pollution, **Eutrophication** 

Edutophication.

1dentifiers: \*Okanagan-Shuswap water basin(B C), Nutrient loading, Penticton(B C), Salmon Arm(B C), Public participation, Pollution Control

Okanagan-Shuswap water basin provides a recreational and scenic environment deteriorating in quality. Water quality management, planning and decision-making processes in 2 small villages that are dependent upon the quality of water for their economic viability are discussed. Each case history examines the political mechanisms available, public attitudes toward water quality and citizen profite attitudes toward water quanty and critizen process of water management. The municipal governments of Penticton, Salmon Arm Village and Salmon Arm District proposed various plans and techniques to effectuate their determined water policies to meet their unique problems, both political and environmental. These case studies show that decisions are constrained by uncertainty of environmental side effects and lack of ecologi-cal data, by financial limitations, by inadequate communication between the public and decisionmakers, and weak senior government guidelines to insure regional cooperation. The latter section of this report explores the implications of Canada's new river basin planning strategy on the evaluation process and describes an evaluation matrix to compare alternative plans. The evaluation matrix involves 3 steps: impact analyses, comparison with zero alternative and weighting schemes. By adding social and environmental impacts to benefit-cost analysis, the evaluation matrix enables more comprehensive and relevant resource management decisions to be made as well as allow multiple-objective planning to be used. (Salzman-North Carolina) W76-03630

EXPERIENCE IN THE SANITARY PROTECTION OF WATER BODIES IN A RAION OF MOSCOW, (IN RUSSIAN),
Sanitary Epidemiology Station, Konakovo

(USSR)

For primary bibliographic entry see Field 5D. W76-03637

IRON BACTERIA AND RED WATER, Dearborn Chemical Div., Mich. For primary bibliographic entry see Field 5B. W76-03640

APPARATUS FOR THE SEPARATION OF DIF-FICULTLY MISCIBLE OR NON-MISCIBLE

LIQUIDS,
O. Kunz, R. Hartmann, and N. Sinnersdorf. United States Patent 3,914,175, Issued October 21, 1975. Official Gazette of the United States Patent Office, Vol 939, No 3, p 1461-1462, October, 1975,

Descriptors: \*Patents, \*Separation techniques, \*Liquids, Equipment, Tanks, Pollutation abatement, Water pollution control.

A patent has been issued for a separation device for liquid dispersions of two or more mutually insoluble or partially soluble liquids. These are separated into individual liquid phases in a separating tank which has side walls and an inlet for the liquid mixture, and zig-zag shaped plate-like fittings arranged in layers one over the the other in the tank. These fittings extend across the tank from side wall to side wall, horizontally in the direction of the liquid throughput. Outlets are located in the peaks and valleys of the overlapping fittings for separating the phases. A diffusion device operates in the form of a fiber or ribbon adjacent to the inlet for the uniform distribution of the liquids as they are separated. A perforated plate extends across a cross-section of the tank, following the diffusing means and immediately preceding the plate-like fittings. (Kramer-FIRL) W76-03660

QUALITY CONTROL STARTS AT THE PIPE. Environmental Protection Agency, Kansas City, Mo. Region VII. For primary bibliographic entry see Field 5A.

W76-03694

DEVELOPMENT OF IRON AND MANGANESE BACTERIA IN RANNEY WELLS. For primary bibliographic entry see Field 5B. W76-03761

TOTAL POPULATION DENSITY OF CRUSTACEA AND AQUATIC INSECTA AS AN INDICATOR OF FENTHION POPULATION OF RIVER WATER, Plant Protection Research Inst., Pretoria (South

L. P. van Dyk, C. G. Greeff, and J. J. Brink. Bulletin of Environmental Contamination and Toxicoloty, Vol 14, No 4, p 426-431, 1975. 1 fig, 1 tab. 3 ref.

Descriptors: \*Pest control, \*Bioindicators, \*Pesticide residues, Density, \*Crustaceans, \*Analytical techniques, Water quality control, Pesticides, \*Avicides, Birds, Water pollution Pesticides, \*Avicides, Birds, Water pollution sources, Water pollution effects, Aquatic popula-tions, Environmental effects, Sampling, Pollutant identification

Identifiers: \*Red-billed quelea, \*Fenthion

The use of fenthion in the pest control of red-billed quelea involves riverside spraying where the birds roost at night. A monitor program involving both the population density of aquatic Insecta and Crustacea, and the analysis of fenthion residue in water samples was tested experimentally. Total population density proved to be a sensitive indicator of fenthion pollution and can be used when no analytical facilities are available. This is an inexpensive method compared to the use of sophisticated collection samplers or resins. The only prerequisite is that the total population density be-fore pollution must be known. (Katz) W76-03779

PROCESS CONTROL AS AN AID TO POLLU-TION CONTROL,

W. Steven.

Water Pollution Control, Vol 74, No 5, p 516-523,

Descriptors: \*Pollution abatement, \*Water pollution control, \*Data collections, \*Control systems, Telemetry, Treatment facilities, Computer pro-grams, Computers, Automatic control, Water works, Equipment, Instrumentation, Waste water treatment, Water treatment. Identifiers: \*Process control, Analytical recor-

Process control as an aid to pollution control as applied to the Carbarns works in the Burgh of Motherwell and Winshaw, England, is discussed.

The design philosophy of an automatic control system must include two elements: accumulation of information must be such that fluctuations in the system must be recorded in considerable detail and number, enabling accurate conclusions on plant performace; and this information must be programmed into the system to automatically allow for such fluctuations. Three types of infor-mation required are physical factors, chemical and biological factors, and early warning factors. The system described is hooked up by telemetry to two other distant treatment facilities. The system consists of a four section control console, logic and recorder cabinets, three typewriters, an analytical 12-point recorder, a tape punch, a computer and auto-dialing equipment. Operating procedures are outlined. It was found, after three months of operation of this system, that designs can always be improved. Plant selection requires careful selection in choosing such a sophisticated system. A detailed description of the physical outline and mechanical details of the plant is required for the software designers. In addition, it is necessary that the methods of operation of the plant should be carefully outlined at the programming stage. (Pinto-FIRL) W76-03795

FEDERAL ENVIRONMENTAL LAWS AND REGULATIONS, Fluor Engineers and Constructors, Inc., Anaheim,

Calif.

E. D. Zarytkiewicz. In: Chemical Engineering, Deskbook Issue, p 9, 11, 13, 15, 17, October 6, 1975. 5 tab.

Descriptors: \*Waste water treatment. \*Water Descriptors: "waste water treatment, "waste quality control, "Water treatment, "Legislation, "Environmental effects, "Federal jurisdiction, Land use, Potable water, Chemical industry, Oil spills, Federal Water Pollution Control Act. Identifiers: Safe Drinking Water Act, Environmental Impact Statements(EIS).

A summary is presented of previous major environmental requirements, recently enacted regu-lations, and future legislation and their potential impacts. Since the National Environmental Policy Act (NEPA) of 1969 was passed, any federal agency must prepare an Environmental Impact Statement(EIS) prior to taking any action that affects the environment. Delays in construction due to the time and money required to draft an EIS have caused excessive costs, which the federal govern-ment has now acknowledged. The 1970 Clean Air Act has set up maximum ambient concentrations for CO, NO2, SO2, non-methane hydrocarbons, and particulate matter. The Federal Water Pollution Control Act of 1972 has probably had the greatest impact on all industries, particularly that of chemical processing, than any other environ-mental law. Regulations of import are: the Namental law. Regulations of import are: the National Pollutant Discharge Elimination System (NPDES); Effluent Guidelines and Standards; Pretreatment Standards; Oil and Hazardous Substances Rules; Ocean Dumping Rules; and Toxic-Pollutant Standards. Other legislation has required that facilities engaging in securities. that facilities engaging in production, consump-tion, or distribution of oil prepare Spill Prevention, Control, and Countermeasure Plan. New laws also apply to the control of noise, solid wastes, and pesticides in the environment. Recent and future legislation includes the Safe Drinking Water Act and new rulings to be initiated on land use control. (Kramer-FIRL) W76-03806

SOCIAL AND ECONOMIC DEVELOPMENT CRITERIA IN POTABLE WATER AND SEWERAGE SYSTEMS (CRITERIOS SOCIALES ECONOMICOS DE DESSARROLLO EN LOS TARILLADO), For primary bibliographic entry see Field 5F. W76-03808 SISTEMAS DE AGUA POTABLE Y ALCAN-

WESSEX: EVOLVING WITH ITS DIVISIONS. For primary bibliographic entry see Field 6E. W76-03811

### THE CONTROL OF POLLUTION OF GROUND-

WATER, Clyde River Purification Board, Glasgow (Scotland)

M. P. Henton

Effluent and Water Treatment Journal, Vol 15, No 9, p 464-467, 473, September, 1975. 1 tab, 21 ref.

Descriptors: \*Waste water disposal, \*Groundwater, Underground waste disposal, \*Water pollution, Legislation, Water pollution sources, Groundwater resources, Waste disposal wells, Waste water(Pollution).

Groundwater pollution should be prevented for several reasons including: it is an increasingly valuable source of water; it is an integral part of the hydrosphere; it can reappear at the surface in the course of time; and, moving wastes from the surface to below ground is only storage and not a form of disposal or treatment. Contamination of groundwater from surface practices includes disposal of effluent to underground strata, leachate from refuse tips, agricultural practices, reachage from reduce tips, agricultural practices, storage of oil, chemicals, and road salt, sewage or industrial settling basins, individual sewage disposal systems, and aquifer discharge. Aquifer overpumping and acid mine drainage are two examples of contamination resulting from the use of groundwater and rock. Contamination can be on a groundwater and rock. Contamination can be on a local or regional scale; each can be just as destructive and long-lasting as the other. The origin and nature of the rock, the structural geology, nature of any faults present, direction of movement of the groundwater, level and fluctuations of the water table, proximity of old mine workings, abstraction has been below as a fine-direction. straction bore-holes or disposal points, and and quantity of waste to be disposed of are all fac-tors which must be considered in a situation concerning groundwater pollution. A hydrogeological report should be prepared with recommendations as to the suitability of any site for the particular purpose in mind. Legislative controls in England on groundwater pollution are discussed. The Control of Pollution Act, 1974, tries to include all forms of pollution and uses a new approach in controlling underground wastes. (Orr-FIRL) W76-03815

# GEOCHEMICAL FACTORS AFFECTING ARTIFICIAL GROUNDWATER RECHARGE IN THE UNSATURATED ZONE,

THE UNSALUKATED ZONE, Geological Survey, Lubbock, Tex. W. W. Wood, and D. C. Signor. Transactions of the ASAE, Vol 18, No 4, p 677-683, July/August, 1975. 11 fig., 1 tab, 14 ref.

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Descriptors: \*Geochemistry, \*Artificial recharge, \*Groundwater, \*Chemcontrol, Chemical analysis, Recharge, Texas, New Mexico, Ion exchange, Anion exchange, Cation exchange, Hydrogen ion concentration, Adsorption, Hydrology.

Identifiers: \*Unsaturated zone, Recharge facility, Lubbock(Tx), Mineral solution, Desorption, Sulfate reduction, Lake Meredith(Tx).

Recent research on artificial groundwater recharge has focused on spatial-temporal aspects. The type and magnitude of chemical controls at a site are studied. Chemical considerations are placed into two categories: the change in geometry of the intwo categories: the change in geometry of the interstitial pore space and the prediction of the quality of the water with time. The observations discussed fall into the second category. The recharge facility used, a 0.4-ha basin near Lubbock, Texas, is typical of the Southern High Plains of Texas and New Mexico, and the water was imported form Loke Mexico, and the water was imported form Loke Mexico. ported from Lake Meredith, near Amarillo. Porous ceramic cups were used to collect water samples at depths of 0.6, 2, 8, 16, 23, and 33 meters, first daily and then weekly. Chemical analyses were per-formed for pH, bicarbonate and specific con-

ductance. Chloride concentration increased with depth. Ion exchange was one of the most important chemical processes observed in the system. Cation and anion exchange took place, but cation exchange dominated. This could be an important consideration in a predictive model, depending on whether or not the water is intended for human consumption. Some sulfate adsorption takes place and the effects are still being studied. Desorption of silica was the other major mechanism that affected the water quality. Sulfate reduction signaled a hydrologic change but the effect was small because of the rapid loss of hydraulic conductivity. Some mineral solution occurred but also had a very small effect. Studies should be con-ducted at other sites on the Southern High Plains of Texas and New Mexico, including more detailed analyses. With enough pertinent data incorporated into a model, accurate predictions can be made on water quality changes. (Pinto-FIRL)

### RESEARCH NEEDS RELEVANT TO ENVIRON-MENTAL DATA, (PAPER OF THE TECHNICAL COUNCIL ON WATER RESOURCES PLANNING AND MANAGEMENT), Environmental Research and Technology, Inc.,

Concord, Mass. Environmental Studies Di For primary bibliographic entry see Field 6G. W76-03823

RESEARCH NEEDS IN THE CONTEXT OF OUR GOAL TO RESTORE AND MAINTAIN THE CHEMICAL, PHYSICAL, AND BIOLOGI CAL INTEGRITY OF THE NATION'S WATERS, National Science Foundation, Washington, D.C. Div. of Advanced Environmental Research and Technology. E. H. Bryan.

In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 4-12, 6

Descriptors: \*Water pollution control, \*Research and development, \*Research priorities, Pollution abatement, Waste water treatment, Water pollu-tion, Technology, Research facilities, Research

The need for various kinds of research to solve water pollution problems is discussed. Both basic and applied research are relatively long-term pro-jects that can be considered investments for the future. It is also important to invest in personnel training and research capability that will be available for implementation of needed additional research, design, construction, operation and maintenance of water pollution control facilities. However, in addition to basic and applied research, a type of research effort that is highly focussed on selected problems with the objective of solving these problems is needed. Problem-focussed research should be in reasonable balance with the more traditional types of basic and ap-plied research. Problem identification, reasearchability and plans for the utilization of results are key factors in the selection of projects that are responsive to problem-focussed research. Since many of our water pollution problems, such as overflows of raw sewage from combined sewers and over-loaded sanitary sewers, are big and expensive, the solutions must be highly cost-effective. There is also the problem of non-point source pollution, such as drainage from urban and agricultural areas. The use of current technologists to deal with current problems should cause powerful economic incentives for further research. (Orr-FIRL) W76-03832

### ZERO DISCHARGE OF INDUSTRIAL WASTE-

Environmental Protection Agency, Washington, D.C. Office of Research and Development. G. Rey, P. DesRosiers, and W. J. Lacy.

In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 22-41. 3 fig, 4 tab, 26 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Water reuse, Recycling, Research and development, Federal Water Pollution Control

Identifiers: \*Zero discharge, Environmental Protection Agency.

The 1972 Federal Water Pollution Control Act, PL 92-500, states that the discharge of pollutants into navigable waters must be eliminated by 1985. The major goals of the Environmental Protection Agency's industrial research and development program include research into water reuse and product or by-product recovery methods. Because industrial water quality requirements for reuse are less stringent than for municipal supplies, direct industrial water reuse (closed-cycle systems) should be technically feasible and economically achievable earlier than comparable muncipal water reuse systems. Waste water reuse is a resource conservation measure and a method of pollution abatement. By-product recovery and utilization techniques can reduce the net cost of waste water treatment and hopefully will become less expensive than disposal. Recycled water is valuable because of intake water supply shortages, increasing water supply and water treatment costs, and rising municipal sewerage charges. The recovery of usable water and thermal energy are recovery of usable water and thermal energy are the main techniques of reducing overall waste treatment costs. To implement water recycling at an industrial plant it is necessary to determine major water use requirements and to establish water quality requirements. A general planning guide for an industrial reuse research and develop-ment program is presented. (Orr-FIRL) W76-03834

### PUBLIC PARTICIPATION IN WATER POLLU-

TION CONTROL,
Environmental Protection Agency, Atlanta, Ga. Region IV. F. E. Ravan.

In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 42-48.

Descriptors: \*Water pollution control, \*Pollution abatement, \*Legislation, Federal Water Pollution Control Act, Local governments, Public rights, Environmental control, Standards. Identifiers: Public participation

A general discussion of the public's role in water pollution control is presented. Under the 1972 Federal Water Pollution Control Act, there must be citizen participation in hearings before the establishment of effluent limitaions for industrial or municipal facilities. In addition, the EPA ador municipal facilities. In addition, the EPA administrator, in cooperation with the States, is required to provide for public participation in the development, revision, and enforcement of any regulation, standards, effluent limitation, plan, or program developed by the Administrator or any State under the Act. Minimum guidelines are set for the participation. In a very few years State regulation of construction on flood plains, or unstable hillsides in swamps in wetlands or in good stable hillsides, in swamps, in wetlands, or in good cropland will probably be routine all over the country. Examples of the advances that citizen groups have made in cleaning up bodies of water, as well as examples of EPA sponsored pollution concern groups are discussed. It is expected that as the population becomes aware of the benefits of pollution control and abatement, strong remedial action will be supported. (Orr-FIRL) W76-03835

### POLLUTION CONTROL OPTIONS OTHER

THAN TREATMENT, Dow Chemical Co., Midland, Mich. Environmental Control Systems.

### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G-Water Quality Control

C. L. Sercu.

In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 64-81.

Descriptors: Waste water treatment, \*Industrial wastes, \*Planning, Environmental control, \*Pollution abatement, Cost-benefit analysis, \*Water pollution control.

The necessary planning that must be performed to ensure the best solution to a waste treatment problem is chosen is discussed. Treatment of industrial wastes is not always the best way to solve the problem. Recovery, reuse, and reduction are alternatives to treatment. These three alternatives can be accomplished by such changes as process modifications, new processes, better housekeeping, and waste segregation. Cost/benefit analyses must be performed to help decide between terminal treatment and alternatives. The key to a successful program is to get commitment for pollution control from the top management. Top management must formulate the policy, goals, and assign the responsibility. Making environmental control a in the determination of raises and promotions will apply meaningful pressure on all personnel involved. (Orr-FIRL) W76-03837

ULTIMATE DISPOSAL BY MEANS OF DEEP WELL INJECTION: A LEGAL VIEW, Virginia Polytechnic Inst. and State Univ.,

Blacksburg. Water Resources Research Center. For primary bibliographic entry see Field 5E. W76-03839

HOW TO COMMUNICATE COMPLEX ISSUES TO THE PUBLIC, Environment Reporter, Washington, D.C.

K. D. Gill. In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 226-

Descriptors: \*Communication, \*Technical writing, Terminology, Technology, Social aspects, Management, Publications, Environmental engineering, Psychological aspects. Identifiers: Technical language, Technical presen-

Lawyers, engineers, scientists, and government officials are among those professionals who have developed specialized languages of their own. Although most of the terms used within a discipline have specific meanings and convey precise thought or concept to people within that discipline, these terms are often meaningless to others. Several practical suggestions are offered for communicating technical specialized thoughts to the public. The first point is to be aware that highly complex technical terms are being used when one discusses his specialty. The clearer the presentation, the better the chance of being understood. The second point is to make use of the press, whether reporters or public relations agen-cies. The ideal situation is to make available to the reporter a copy of the presentation. (Orr-FIRL) W76-03848

THE PORTS AND WATERWAYS SAFETY ACT OF 1972: AN EXPANSION OF THE FEDERAL APPROACH TO OIL POLLUTION Kelso, Spencer, Synder and Stirling, Honolulu,

M. S. Davis

Journal of Maritime Law and Commerce, Vol 6, No 2, p 249-257 (1975). 9 p, 60 ref.

Descriptors: \*Legislation, \*Oil spills, \*Oil pollution, \*Regulation, \*Control, Harbors, Navigable waters, Standards, Design standards, Legal

aspects, Coast Guard regulations, Law enforcement, Negligence, Penalties(Legal), Water law, Oil, Water Quality Act, Administration, Water pollution sources, Disaster, Oil wastes, Water pollution, Water pollution control. Identifiers: \*Environmental policy, \*Hazardous substances(Pollution), \*Liability(Legal aspects), \*Oil Pollution Act, Absolute liability, Administrative regulations, Intentional torts, Non-point sources(Pollution), Nuisance(Legal aspects), Territorial waters

This article discusses the provisions and ramifica-tions of the Ports and Waterways Safety Act of 1972, which was enacted to combat the problem of oil spills in areas around ports, waterfronts, and the navigable waters of the United States. Com-paring similar legislation which preceded the Act, the article states that prior to the Ports and Waterways Safety Act, the object of oil pollution legisla-tion was to deter intentional discharges of oil through sufficiently severe penalties. Accidental rather than intentional oil spills were at the crux of the oil pollution problem. In response, the 1972 Act exemplifies legislation designed to prevent both intentional and accidental oil spills. The Act is an attempt to prevent accidental oil spills through the implementation of a system of vessel traffic control, and the imposition of construction safety standards. While acknowledging the con-cern of some skeptics with regard to the effective-ness of the Act, the author concludes that the real significance of the Port and Waterways Safety Act is its demonstration that Congress has shifted its concern to the more crucial problem of prevention of accidental oil pollution. (Fernandez-Florida)

WATER POLLUTION, Stanford Environmental Law Society, Calif. R. W. Harris, W. Jeffery, and B. W. Steward, Jr. In: Interstate Environmental Problems, p 57-84 Standord Law School, Stanford, California, 1974. 28 p, 124 ref.

Descriptors: \*Federal Water Pollution Control Act, \*California, \*Surface waters, \*Water pollu-tion sources, \*Pollution abatement, Biochemical oxygen demand, Rivers, Dissolved oxygen, Coliforms, Trout, Minnows, Groundwater, Agriculture, Pesticides, Bacteria, Detergents, Standards, Acid mine water, Urbanization, Water Standards, Acid mine water, Urbanization, Water quality, Lakes, Permits, Sewage treatment, Organic wastes, Pollutant identification. Identifiers: Truckee River, Federal Water Pollution Control Act Amendments of 1972, Lake Tahoe, Trout standard, Golden Shiner Minnow, Non-point sources(Pollution), Effluent limitations, Feedlots, Environmental Protection Agency, Eighbeith, Administrative requisitions. cy, Fishkills, Administrative regulations

The types and mechanisms of water pollution, the various legal means of protecting water quality, and the application of those means in the Lake Tahoe-Truckee River area in California are surveyed in this article. Types of pollutants include: organic wastes, infectious agents, plant nutrients, synthetic organic chemicals, inorganic chemicals, sediments, radioactive wastes, and thermal pollution. A particularly destructive type of pollution is created by the meat packing industry by penning animals in feedlots. Various chemical techniques are available for detecting pollutants, as well as are available for detecting pollutants, as well as natural techniques such as the trout standard. Once a pollution problem is detected, water quality control authorities may compel abatement under the 1972 Amendments to the Federal Water Pollution Control Act (FWPCA), which places limitations on the discharges of effluents into navigable waters. In California, there are nine separate Regional Water Quality Control Boards in charge of enforcing FWPCA requirements. in charge of enforcing FWPCA requirements. An examination of the Tahoe-Truckee system, how-ever, reveals that federal requirements often conwith state needs, and that solution to one part of the water quality problem-sewage treatment-can have adverse consequences in other areas of the environment. (Parrish-Florida)

W76-03921

W76-03924

NAVAL SUBMARINE BASE, NEW LONDON, GROTON, CONNECTICUT DREDGE RIVER CHANNEL, VOLUME 1, (ENVIRONMENTAL IMPACT STATEMENT). Department of the Navy, Washington, D.C. For primary bibliographic entry see Field 8A.

**ENVIRONMENTAL LAW--1974 STYLE.** Environmental Science and Technology, Vol No 3, p 194-195 (March 1975). 2 p, 1 tab, 1 chart. Vol 9

Descriptors: \*Water quality control, \*Potable water, \*Public health, \*Water purification, Water supply, Water law, Water management(Applied), Legislation, Penalties(Legal), Domestic water, Standards, Pollutants, Wastes, Charts, Governmental intergrations. mental interrelations Identifiers: Safe Drinking Water Act.

The Safe Drinking Water Act requires the Environmental Protection Agency (EPA) to establish national primary drinking water regulations pro-tective of public health, and national secondary drinking water standards protective of public welfare. States are given the primary responsibility for enforcement of these standards if they so elect; if not, the EPA has the responsibility. Civil penalties are provided for violations. The Act also calls for studies by the National Academy of Sciences (NAS) to comment on the availability of drinking water, to report to Congress on the availi-bility of such standards, and to determine maximum contaminant levels protective of public health. After the NAS study to determine the maximum contaminant levels, revision of national primary drinking water regulations will occur once every three years. A chart is provided at the end of the article which provides effective dates for various provisions and regulations. (Hoffman-Florida) W76-03927

NAVIGABLE WATERS OF THE COMMON-WEALTH OF KENTUCKY WATER QUALITY STANDARDS). (PROPOSED

Environmental Protection Agency, Washington, Federal Register, Vol 39, No 188, p 34574-34575, Sept 26, 1974, 2 p.

Descriptors: Federal government, \*Federal Water Pollution Control Act, \*Kentucky, \*Water quality standards, \*Administrative decisions, Navigable waters, Regulation, Administration, Decision making, Water policy, Water law, Water quality control, State governments, Governmental interrelations, Classification, Adoption of practices. Identifiers: \*Interstate waters, \*Intrastate waters.

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These proposed regulations set forth standards of water quality to be applicable to the Common-wealth of Kentucky pursuant to section 303(c)(4)(B) of the Federal Water Pollution Control Act (FWPCA). Under that section of the FWPCA, the Administrator of the Environmental Protection Agency (EPA) is required to review water quality standards for waters of the United States which have been adopted and submitted by the States and approved by the EPA. When he determines that changes in such standards are necessary to meet the requirements of the Act, the Administrator must prepare and publish proposed revised water quality standards. After the enactment of the 1972 Amendments to the FWPCA, the EPA reviewed Kentucky's water quality standards for both interstate and intrastate waters, and found that changes were needed. As a result of the decision Kentucky submitted new standards to the EPA which were approved in 1974. Further study by the Administrator, however, showed that not all navigable waters in Kentucky were classified by water quality standards as required by the FWPCA. These proposed regulations provide

standards for those waters found not to be covered by the Kentucky water quality standards sub-mitted to the EPA in 1974. (Hoffman-Florida)

NAVIGABLE WATERS OF STATE OF ARIZONA.

Environmental Protection Agency, Washington,

Federal Register, Vol 39, No 200, p 36866-36867, October 15, 1974, 2 p.

Descriptors: \*Arizona, \*Water quality standards, \*Nutrients, \*Federal Water Pollution Control Act, \*Navigable waters, Regulation, Nutrient requirements, Governmental interrelations, Law enforcement, Administrative decisions, Administrative agencies, Water quality control, Interstate rivers, Standards, State government.

Identifiers: \*Intrastate waters FWPCA Amendments of 1972.

The Federal Water Pollution Control Act (FWPCA) requires that state water quality standards for navigable waters be reviewed by the Administrator of the Environmental Protection Agen-cy (EPA). A review conducted after the passage of the 1972 amendments to the FWPCA found that revisions were needed in Arizona's water quality standards for interstate and intrastate waters. Subsequently, Arizona adopted revised water quality standards. These new standards, however, did not fully meet the requirements of the FWPCA since they established no quantitative nutrient criteria. Therefore, under the authority of the FWPCA, the EPA is proposing regulations which set forth standards necessary for Arizona to comply with the Act. Those regulations are set forth in this notice and will become effective immediately upon republication. (Hoffman-Florida)

CRITERIA FOR THE EVALUATION OF PER-MIT APPLICATIONS (OCEAN DUMPING).

Environmental Protection Agency, Washington, D.C.

W76-03931

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d ie Federal Register Vol 39, No 202, p 37057-37058, October 17, 1974, 2 p.

Descriptors: \*Sites, \*Waste dumps, \*Gulf of Mexico, \*Organic wastes, \*Incineration, Chlorides, Permits, Regulation, Ultimate disposal, Ships, Industrial wastes, Water pollution sources, Chemidustrial wastes, water pointoin sources, chemi-cal wastes, Solid wastes, Organic matter, Waste disposal, Waste storage, Oceans. Identifiers: \*Ocean dumping.

The authority to designate ocean dumping sites was vested in the Administrator of the Environ-mental Protection Agency by the Marine Protec-tion, Research, and Sanctuaries Act of 1972. Pursuant to that authority, the Administrator has designated a new site in the Gulf of Mexico to be used for high temperature incineration of organic chloride wastes. The new site is necessary because the Shell Chemical Company's permit to dispose of its organic chloride wastes has expired, resulting in Shell's accumulation of more than 19,000 tons of waste. To dispose of this accumulation, Shell contracted for the use of a motor vessel for at-sea incineration of the wastes. Before the vessle could carry out the incineration, however, it had to comply with all pertinent governmental regula-tions, Thus, an application for the designation of a new dumping site was submitted and approved by the EPA. Because the location of the site had been previously considered at a public meeting, and because the motor vessel would be available for only a limited time, the designation of the new site will take effect immediately. (Hoffman-Florida) W76-03932

TEXAS COUNTY IRRIGATION AND WATER RESOURCES ASS'N V DUNNETT (SALT WATER INJECTIONS INTO GLORIETTA

SAND FORMATION NOT POLLUTANT OF FRESH WATER AQUIFIER). For primary bibliographic entry see Field 6E. W76-03950

COMMUNITY COLLEGE V. FOX (CLEAN STREAMS LAW OR SEWAGE FACILITIES

For primary bibliographic entry see Field 6E. W76-03951

CITY OF BRUCE V. EDWARDS (ACTION TO RECOVER DAMAGES FOR LAND FLOODED BY CONSTRUCTION OF SEWER LAGOON BY

For primary bibliographic entry see Field 6E.

UNITED STATES V. DIAMOND (ACTION TO ENJOIN IN CERTAIN SALT WATER TIDAL MARSHLANDS).

For primary bibliographic entry see Field 6E.

UNITED STATES V. DETREX CHEMICAL IN-DUSTRIES, INC. (VIOLATION OF POLLUTION DISCHARGE PERMIT). For primary bibliographic entry see Field 6E.

EMERGING ISSUES IN FEEDLOT WASTE MANAGEMENT.

Texas A and M Univ., College Station. J. M. Sweeten. Feedlot Management, Vol 17, No 5, p 16, 18, 23, 26, May, 1975.

Descriptors: \*Farm wastes, \*Feed lots, \*Agricultural runoff, \*Odor, Recycling.
Identifiers: \*Waste management, Application rates, Refeeding, Sediment management.

This report discusses areas of needed improvement that are emerging in feedlot waste management. Since many feedlots have invested from \$.50 to \$7.00 per head of capacity for runoff control systems, care needs to be taken to protect these investments. One common problem is failure to dewater the retention structures within a prescribed time period following a major storm. Another problem is the proper determination of the right runoff application rates on crop or pasture land. Sediment management in retention ponds must also be dealt with. Possible solutions for these problems are projected. The quality of manure used in crop disposal has recently become a pressing issue. Attempts are being made to improve manure quality through better handling techniques. Animal wastes have been found to have value when recycled as gas or as feeds, but there are still problems to be worked out. Although all of the above are important aspects of feedlot management, the area with the greatest need of research is odor control. Because of the legal aspects of the odor problem, there is a great need for more research on odor measurement, odor control techniques, and prediction of odor trans-port phenomena. (Penrod-East Central) W76-03968

MANAGE MANURE FOR ITS VALUE, Wisconsin Univ., Madison. Coll. of Agricultural and Life Sciences For primary bibliographic entry see Field 5E.

W76-03969

MODEL TO PREDICT THE PERFORMANCE OF FEEDLOT CONTROL FACILITIES AT SPECIFIC OREGON LOCATIONS,

Oregon State Univ., Corvallis. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 5D.

W76-03971

LEGAL ASPECTS OF WASTE POLLUTION

Kansas Livestock Association, Topeka.

Beef in Confinement Workshop, National Feed Ingredients Association, Des Moines, Iowa, April 4, 1974, p 27-29. 1 fig.

Descriptors: \*Farm wastes, \*Legal aspects, \*Feed lots, \*Water pollution.
Identifiers: \*Water Pollution Control Act Amend-

ments of 1972. Zero discharge.

The 92nd Congress has passed a Public Law 92-500, better known as the Water Pollution Control Act Amendments of 1972. This represented the first time that the Federal Government got into the business of regulating feedlots as they relate to the environment. Feedlots are specifically defined in the act as a 'point sources' of water pollution. The Federal Water Pollution Control Act Amendments made some unprecedented demands on the livestock industry. It states '...it is the national goal that the discharge of pollutants into navigable water be eliminated by 1985'. That section seems to imply zero discharge. It is impossible to guarantee zero discharge. The Environmental Protection Agency has not developed a set of rules or guidelines for the disposal of wastes, except to recognize that application on agricultural land appears to be the most practical method. The Environmental Protection Agency recommends that operators fill out a Short Form B so that they will be on record with them. (Cartmell-East Central) W76-03975

RACEWAYS: EXOTIC SPECIES MOST AF-FECTED BY PROPOSED E.P.A. DISCHARGE

Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management.

D. D. Culley, Jr. The American Fish Farmer, Vol 4, No 8, p 9-12,

July 1973.

Descriptors: \*Regulation, \*Permits, \*Water pollution, Fish farming, Lagoons, Filtration, Recirculated water, \*Waste treatment, \*Farm wastes.

Identifiers: Non-native fish.

The proposed amendment of Part 125, Title 40 of the Code of Federal Regulations will affect the licensing control of pond and raceway aquaculture facilities discharging wastes more than 30 days yearly and of non-native aquatic animal produc-tions. Raceway facilities having continuous discharge would require licensing or converting to recirculating filtration or lagoon holding systems. A permit system should serve as an incentive for aquaculturists to become more efficient in their operations. There is reason to believe that through increased efficiency of reclaiming wastes or recir-culating his water, the culturist can increase profits. (Hargrove-East Central) W76-03980

IMPACTS OF IMPOSING SELECTED POLLU-TION CONTROLS,

Michigan State Univ., East Lansing. Dept. of Agricultural Economics.

D. Good, L. J. Connor, J. B. Johnson, and C. R.

Michigan Farm Economics Report No. 360, Cooperative Extension Service, Michigan State University, East Lansing, January, 1973, 4 p, 2

Descriptors: \*Farm wastes, \*Michigan, \*Dairy industry, \*Legal aspects, \*Costs, \*Agricultural ru-noff, Odor, Waste storage. Identifiers: Pollution control, Land disposal, Subsurface disposal.

### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G-Water Quality Control

Three selected pollution control measures are analyzed which might conceivably be applied to Michigan dairy farms. The measures are based on recent actions taken by the Michigan Water Resources Commission and Air Pollution Control Division and on statutes relative to dairy waste management that have been enacted or proposed in adjoining states. The first control measure requires control of surface water runoff at the production site. The second measure, designed to control runoff from fields to which wastes are ap-plied, prohibits winter spreading of dairy wastes. The last measure, designed to reduce odors and field runoff associated with land application of dairy wastes, requires immediate plow-down of solid dairy wastes and/or soil injection of liquid dairy wastes. Twelve 'representative' farms were chosen for the study. Adjustments necessary to comply with the control measures were identified. These control measures will cause increased cost of operation which will inevitably be passed on to the consumer. Projections of increased costs are given. (Penrod-East Central)
W76-03982

KEEPING THE FEEDER IN BUSINESS. Soil Conservation Service, Lincoln, Nebr.

L. G. Jackson. Soil Conservation, Vol 39, No 2, p 10-11, Sep-

tember, 1973, 3 fig

Descriptors: \*Farm wastes, \*Nebraska, \*Feed lots, \*Regulation, Water pollution, Design, Waste

The 17,000 feedlots in Nebraska cause a great many waste management problems. The Soil Conservation Service engineered a system to prevent runoff at the request of a 1000-head Adams County feedlot. A bypass system was devised that inty tecutor. A bypass system was devised that in-volved keeping a farm pond from discharging into the feedlot. A debris basin and holding pond were then designed that would control a 10-year, 24 hour storm that could cause runoff from the lot. The lot was sold before the system was implemented, and the new owners doubled the feedlot capacity, making it necessary for a new debris basin to be installed. The farm pond was changed to a tailwater recovery pit to which all liquid waste was carried. A pipeline was installed to carry liquid waste to the high point in the disposal area for distribution to the croplands by irrigation. Costs of the system were \$3700. At the time of this publication, about 650 waste control systems had been installed on Nebraska feedlots, and more were in the design stage. All these feedlots are carefully inspected by the Department of Environmental Control in order to assure that owners do not violate water quality standards. (Sanders-East Central) W76-03983

STATUS OF THE ILLINOIS LIVESTOCK WASTE MANAGEMENT REGULATIONS, Illinois State Environmental Protection Agency,

Springfield. Div. of Water Pollution Control.

Presented at Proceedings of 1973 Livestock Waste Management Conference, Champaign, Illinois, March 7-8, 1973, p A1-A5.

Descriptors: \*Farm wastes, \*Illinois, \*Legal aspects, \*Feed lots, Permits, Design, \*Regulation. Identifiers: \*Waste management.

In its later years of existence, the Illinois Sanitary Water Board (SWB) conceived the need for a set of livestock waste management regulations. On July 1, 1970, the SWB's activities were taken over by the Illinois Environmental Protection Agency (ÉPA). This agency continued the formulation of the livestock waste management regulations. The hearing process and the Illinois EPA's role and position are discussed. Federal regulations are then examined. The U.S. EPA published on December 5, 1972, a proposed set of regulations

which covered some agricultural operations. Agricultural interests gave extensive response and a task force was set up to evaluate the responses, a task force was set up to evaluate the responses, and, if necessary, redraft and clarify the proposal. A new proposal was drafted during a two-day meeting of this task force which was held on January 29, 1973. After several public meetings with environmental groups, the proposed regulations were published in the Federal Register and a 30-day comment period was set. The operators of various classes and sizes of feedlots or livestock shelters (as listed in a table) must apply for per-Future plans of the Illinois EPA are discussed.

(Penrod-East Central) W76-03984

MY WASTE-HANDLING SYSTEM FOR BEEF. K. H. Bartels

Presented at Proceedings of 1973 Livestock Waste Management Conference, Champaign, Illinois, March 7-8, 1973, p L1.

Descriptors: \*Farm wastes, \*Agricultural runoff, \*Water pollution, \*Feed lots, \*Costs, \*Cost shar-

Identifiers: Holding ponds.

The report discussed the correction of a feedlot wastes runoff problem. Runoff was going directly into a drainage ditch approximately 100 feet from the feedlot. With the aid of the Soil Conservation Service a waste control plan was devised. The only equipment changed for the waste handling procedure was a pump and irrigation equipment for dispensing water from the holding pond. The approximate completion cost of the project will be about \$3,200 (excluding pump and equipment), but cost-sharing was utilized. The runoff now no longer pollutes the creek and the area below the feedlot is much cleaner. (Penrod-East Central) W76-03986

### 6. WATER RESOURCES PLANNING

### 6A. Techniques Of Planning

MODERNIZING STATE WATER RIGHTS LAWS: SOME SUGGESTIONS FOR NEW DIRECTIONS.

California State Water Resources Control Board Sacramento.

For primary bibliographic entry see Field 6E. W76-03593

REGIONAL SKEW IN SEARCH OF A PARENT, Geological Survey, Reston, Va. For primary bibliographic entry see Field 2E. W76-03899

#### 6B. Evaluation Process

SOCIAL, POLITICAL, REGULATORY AND MARKETING PROBLEMS OF MARINE WASTE-FOOD RECYCLING SYSTEMS,

WASTE-FOOD RECYCLING SYSTEMS, Woods Hole Oceanographic Institution, Mass. J. E. Huguenin, and J. T. Kildow. In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 344-356. 23 ref, 3 tab.

Descriptors: \*Aquiculture, \*Sewage lagoons, \*Marine animals, Marketing, Political aspects, Regulation, Social aspects, Sewage effluents, Public health, Pollutants, Food chains, Water pollution control, Water pollution treatment, Social adjustment, Recycling.

There are several prerequisites before social acceptance of the use of sewage ponds to grow

aquatic food animals is a realistic possibility. All legitimate public health concerns must be adequately assessed and resolved. There are also adequately assessed and resolved. Intere are also unknowns involving the transmittal and concentration of various pollutants through complex food chains which include man, and the long term effects of these processes. Systems must be developed to reduce or circumvent the high risk areas, and adequate public health safeguards must be provided. Definite markets must either exist or be created for even low-risk waste-food systems to receive social and regulatory acceptance. With respect to 'safe' levels of contaminants in foods, it respect to safe levers of contaminants in floods, it is suggested that waste-grown seafood ue, in all respects, as good as or better than the same products found on the market from natural sources. The most critical factor affecting the consumer acceptance of waste-grown sea food is the degree and circumstances surrounding its dif-ferentiation from the other sources of the same products, as may be required by regulatory agen-cies. (See also W76-03541) (Witt-IPC) W76-03563

RECYCLING FOR A PURPOSE -- BUT FOR WHAT PURPOSE. A SOCIOLOGIST'S VIEW, Central State Univ., Edmond, Okla. Dept. of Sociology

L. H. Irving. In: Wastewater Use in the Production of Food and Fiber -- Proceedings, March 5-7, 1974, Oklahoma City, Oklahoma, p 357-361. 8 ref.

Descriptors: \*Wastes, \*Recycling, \*Social change, Attitudes, Decision making, Motivation, Social aspects, Psychological aspects, Water pollution control, Water pollution sources.

In order to achieve a social change of attitude toward a new philosophy of life (e.g., recycling of wastes) the social scientist will have to be familiar with the current thinking and trends being developed in the physical scientific community. He will have to evaluate the current level of thinking of the community and design a program to institute social change and implement these changes in order to bring the social acceptability of the community in line with the degree of current technical know-how. (See also W76-03541) (Witt-IPC) W76-03564

INDIANA DUNES NATIONAL LAKESHORE (S

For primary bibliographic entry see Field 6E. W76-03600

PLANNING ASSISTANCE TO STATES (TO AID IN PREPARATION OF COMPREHENSIVE PLANS FOR WATER AND RELATED IN PREPARAT PLANS FOR RESOURCES).

Corps of Engineers, Washington, D.C. Federal Register, Vol 40, No 25, p 5484-5492, Feb 5. 1975, 9 p.

Descriptors: \*Water resources development, \*Comprehensive planning, \*Governmental interrelations, \*Coordination, \*Optimum development plans, Management, Water conservation, River basin development, Government finance, Regulation, Water policy, Alternate planning, State jurisdiction, Natural resources, Planning, Multi-purpose projects regional development, State governments, Federal government. ments, Federal government.
Identifiers: \*Water Resources Development Act,

Water resources planning programs.

This proposed regulation provides basic policies and general guidelines for Corps of Engineers participation in the state assistance program authorized by section 22 of the Water Resources Development Act of 1974. Before the Corps will aid a state, the state must have a planning program for the development, utilization or conservation of water and water resources underway of laid out

into sufficient detail so that the relationship of the state's request for Corps input to some particular aspect of the program may be appraised. Any input from the Corps will be on effort or service sharing basis rather than in the form of an outright snating basis rather than in the form of an outriging rant. Normally the effort will be in an area of Corps expertise, such as comprehensive basin planning, in which the Corps has legislative authority. Some of the general guidelines concernations of the control of the general guidelines concernations. ing the assistance provide the mutually understood goals will be agreed upon with the state before the goals will be agreed upon with the state before the Corps enters into a cooperative planning effort, and that duplication of effort and interagency disputes must be avoided. Also included in the regulation are sections concerning program management and funding. (Hoffman-Florida) W76-03605

OKANAGAN WATER DECISIONS, Simon Fraser Univ. Burnaby (British Columbia). Dept. of Geography.
For primary bibliographic entry see Field 5G.
W76-03630

### SCIENCE VS. MYSTICISM,

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Water Well Journal, Vol 29, No 12, p 26-27, December, 1975.

Descriptors: Locating, Drilling, Exploration, Water wells, Technology, Water sources. Identifiers: Water witching, Dowsing.

A driller is far better off using science and technology in choosing a location for a well than a dowser. There are two reasons for this: (1) he is much more likely to find water, (2) as a result of expanded educational programs, customers expect and require more sophisticated services and an explanation of the services they are to receive. A number of federal, state, and local agencies will provide the well driller with the basic data for the area in which he is working. The nearest office of the United States Geological Survey also will provide information. Another alternative would be to contact local colleges with geology and hydrology departments who may have completed studies in the area in question. (Fuller-NWWA) W76-03762

#### HOW TO COMMUNICATE COMPLEX ISSUES TO THE PUBLIC,

Environment Reporter, Washington, D.C. For primary bibliographic entry see Field 5G. W76-03848

WATER ALLOCATION, Stanford Environmental Law Society, Calif. For primary bibliographic entry see Field 4A. W76-03920

## THE ECONOMICS OF GEOTHERMAL RESOURCES IN THE IMPERIAL VALLEY: A

PRELIMINARY ANALYSIS, California Univ., Riverside. Graduate School of

For primary bibliographic entry see Field 3E. W76-03959 Administration

### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

## COST SHARING FOR RECREATION: EFFI-

CIENCY AND EQUITY': COMMENT, National Bureau of Standards, Washington, D.C. Building Economics Section. H. E. Marshall.

Land Economics, Vol 51, No 3, p 300-303, 1975. 1 tab, 3 ref.

Descriptors: \*Distribution, \*Economic efficiency, \*Cost sharing, Equity, Recreation, Cost-benefit analysis, Water resources development, Local

The conclusions reached by Miller and Scherr in 'Cost Sharing for Recreation: Efficiency and Equity', (1974) based on the methodology developed by Marshall (1970) are questioned. (See W74-07307 and W71-00755). It is claimed that w/4-0/30/ and w/1-00/3). It is claimed that Miller and Scherr have misapplied the analysis in the original Marshall Paper in the following ways: (1) They do not really show efficiency impacts of different cost-sharing rules; (2) they accept Marshall's Association Rule, but fail to explain allocation of total costs for the multiple-purpose project necessary to arrive at recreation costs; (3) they do not actually treat cost-sharing rules as such; they conclude that changing cost-sharing rules are a weak method of redistributing cost by income class; and (4) they maintain that local benefits diminish. As a result of this misapplication their conclusions regarding scale, distribu-tions, and facility mix for recreation cost sharing are not convincing. (Carpenter-Wisconsin) W76-03535

### REPORT ON WASTEWATER SERVICE CHARGES, METROPOLITAN SEWERAGE DIS-BUNCOMBE COUNTY, CAROLINA. Greeley and Hansen, Chicago, Ill.

For primary bibliographic entry see Field 5G. W76-03628

# THE ECONOMICS OF GEOTHERMAL RESOURCES IN THE IMPERIAL VALLEY: A PRELIMINARY ANALYSIS, California Univ., Riverside. Graduate School of

Administration. For primary bibliographic entry see Field 3E. W76-03959

#### 6D. Water Demand

### MEASURING OUR WATER SUPPLY,

In: Our Natural Resources: The Choices Ahead, U.S. Department of Interior, Conservation Year-book, Series No 10, p 29, 1974. 1 p, 1 illus.

Descriptors: \*Flood data, \*Flood plain zoning, \*Flood profiles, \*Geologic mapping, Water supply, Development, Water resources development, Water levels, Comprehensive planning, Mapping, Water utilization, Warning systems, Flood control, Flood forecasting. Identifiers: Upstream drainage.

Statistics are given concerning the amount of water used in this country. Despite an increasing demand, the overall water supply is more than adequate to meet foreseeable needs, providing we bear the cost of keeping it clean, storing and trans-porting it and increasingly recycling it. To help communities meet future demands, the Geological Survey is conducting a flood-prone-area mapping program to delineate the approximate flood boundaries of streams across the nation. The informa-tion on flood-prone areas is presented on quadran-gle maps which then serve as valuable guides for public agencies and private citizens concerned with land development. Flood areas have been identified for: (1) urban areas where the upstream drainage basin exceeds 25 square miles, (2) rural areas in humid regions where the upstream drainage exceeds 100 square miles, (3) rural areas in semiarid regions where the upstream drainage basin exceeds 250 square miles. (Hoffman-Florida) W76-03597

FLOOD HAZARD PATTERNS OF URBAN DEVELOPMENT IN THE UPPER MIDWEST, Western Illinois Univ., Macomb. Public Policy Research Inst. For primary bibliographic entry see Field 4A. W76-03627

### REPORT ON WATER FOR ENERGY IN THE

UPPER COLORADO RIVER BASIN.
Bureau of Reclamation, Denver, Colo. Water for
Energy Management Team.
July 1974. 71 p, 8 fig, 17 tab.

Descriptors: \*Water resources, \*Energy, \*Colorado River Basin, \*Oil shales, Fuels, Electric power, Electric powerplants, Cooling water, Colorado River compact, Consumptive use, Reservoirs, Surface waters, Water storage, Water requirements, Water supply, Agriculture, Groundwater, Legal aspects, Water law, Weather modification, Water management(Applied).

The water resources and water needs for energy in the Upper Colorado Basin were reviewed. It was concluded that sufficient water in the Upper Basin to meet energy developments and other an-ticipated needs to the year 2000 will not be availa-ble unless certain state and federal actions are taken soon. These actions include strong state leadership in the resolution of water rights and water allocation actions and the attainment of effiwater allocation actions and the attainment of efficiency in water use. Additional storage facilities will be required and augmentation of the supply will be needed through weather modification. Groundwater can be utilized as an interim supply prior to development of surface storage and subsequently as a conjunctive supply. The adoption of air cooling for thermal powerplants and the shift of water use from agriculture to industry will also be necessary to some extent. It should be noted that this nicture is the situation as it is seen today, only this picture is the situation as it is seen today; only the prototype oil shale program has been evaluated, and the rapidly changing energy situation can produce a much different picture in a short time.

## THE FUTURE OF WATER RESOURCES IN NORTHEASTERN ILLINOIS,

Illinois State Water Survey, Urbana

W. C. Ackermann. Journal of the American Water Works Association, Vol 67, No 12, p 691-693, December 1975. 1

Descriptors: "Water resources, "Systems analy-sis, "Lake Michigan, "Illinois, Water supply, Water transfer, Water values, Water require-ments, Water demand, Groundwater, Surface waters, Population, Withdrawal, Minning, Repharce Planning, Artificial repharce, Costs

ments, Water demand, Groundwater, Surface waters, Population, Withdrawal, Mining, Recharge, Planning, Artificial recharge, Costs, Flow augmentation, Groundwater resources. Identifiers: \*Northeastern Illinois, \*Lake Michigan water, Water deficiets, Groundwater deficiencies, Mining aquifers, Raw water, Future demands, Least-cost study, Digital simulation model

Several possibilities were investigated for increasing water supplied before the year 2020 for six northeastern Illinois counties. A United States Supreme Court decree of 1966 limited Illinois to 3200 cubic feet per second of Lake Michigan water. Many towns in the area were expecting water deficits by the year 1990 unless additional water could be secured from Lake Michigan or developed from page of all that time unusable water could be secured from Lake Michigan or developed from new or, at that time, unusable sources. The Illinois State Water Survey undertook a complete systems analysis of water resources and future water demands in northeastern Illinois. A second detailed analysis considered economic aspects of groundwater development in the area. The cost of raw and treated groundwater produced in quantities sufficient, in most cases, to meet projected demand to 2020 was estimated for 10d area townships. Water from shallow sond agui. 104 area townships. Water from shallow sand aqui-

### Field 6-WATER RESOURCES PLANNING

### Group 6D-Water Demand

fies, shallow dolomite aquifers, and deep sandstone aquifers was considered. Unit cost of treated water varied from 22-53 cents per 1000 gallons. It was concluded that additional water could come from the Kankakee River, groundwater recharge, reuse, and possibly from treated brackish water from deep aquifers. Eventually, it was concluded that a substantial quantity of Lake Michigan water will be needed, particularly in areas peripheral to those now using Lake Michigan water. (Roberts-ISWS) W76-03755

BULL RUN SAFE YIELD STUDY, For primary bibliographic entry see Field 4A. W76-03792

WATER RESOURCES IN NORTHUMBRIA WITH PARTICULAR REFERENCE TO THE KIEDLER WATER SCHEME, Northumbrian Water Authority (England). Northumberland and Tyne Div. For primary bibliographic entry see Field 6E.

APPENDIX 15, IRRIGATION, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 3F. W76-03868

EVALUATION AND PROPOSED STUDY OF POTENTIAL GROUND-WATER SUPPLIES, GALLUP AREA, NEW MEXICO, Geological Survey, Albuquerque, N. Mex. For primary bibliographic entry see Field 4B. W76.03905

WATER RIGHTS LAWS IN THE NINETEEN WESTERN STATES, VOL 11, Economic Research Service, Washington, D. C., Natural Resources Economic Div. For primary bibliographic entry see Field 6E.

#### 6E. Water Law and Institutions

WASTEWATER FOR FOOD AND FIBER,
Virginia Polytechnic Inst. and State Univ.,
Blackburg. Water Resources Research Center.
W. R. Walker, and W. E. Cox.
In: Wastewater Use in the Production of Food and
Fiber — Proceedings, March 5-7, 1974, Oklahoma
City, Oklahoma, p 330-343, 39 ref.

LEGAL CONSTRAINTS ON THE USE OF

Descriptors: \*Waste water disposal, \*Legal aspects, \*Irrigation programs, Foods, Fibers(Plant), Legislation, Sewage effluents, Waste water treatment, Governments, Federal government, Land use, Surface waters, Groundwater, Water quality, Planning, Design, Wastes, United States.

The recycling of municipal sludges and effluents on land has been used more extensively in other parts of the world than it has in the continental United States; therefore, this alternative for waste disposal has not had an in-depth evaluation in the United States relative to other methods. Legal aspects covering land disposal of effluents are examined, including Federal and State regulations, land use policies affecting the application of waste water, and legal constraints on land application of waste water that may result from alteration of surface and groundwater quality and flow patterns. Consideration of potential legal constraints must be an integral part of the planning and design of systems for applying waste water to land. Because of the nature of these constraints, they cannot be

treated as final design considerations, but must be kept in mind from the initiation of planning. Failure to give complete and timely recognition to these constraints is likely to produce problems during the operational stage and result in inefficiency and frustration in the application of the concept. (See also W76-03541) (Witt-IPC) W76-03562

A PROGRESS REPORT ON THE INTERNA-TIONAL CONVENTION ON CIVIL LIABILITY FOR OIL POLLUTION DAMAGE AND ITS SUP-PLEMENTARY FUND CONVENTION, Office of the Judge Advocate General (Navy), Washington, D. C. For primary bibliographic entry see Field 5G. W76.0384

THE FEDERAL WATER POLLUTION CONTROL ACT AND FORESTRY, National Forest Products Association, Washington, D.C. Environmental Quality Dept. For primary bibliographic entry see Field 5G. W76-0388

A SUGGESTED STATE FOREST PRACTICES ACT (MECHANISM FOR IMPROVING WATER QUALITY ON FOREST LANDS), Environmental Protection Agency, Washington, D. C. For primary bibliographic entry see Field 5G. W76.0387

INDIAN PRIOR AND PARAMOUNT RIGHTS VERSUS STATE RIGHTS (INDIAN WATER RIGHTS), Bureau of Indian Affairs, Washington, D. C. W. H. Veeder.
North Dakota Law Review, Vol 51, No 1, p 107-136 (1974), 30 p, 161 ref.

Descriptors: \*Indian reservations, \*Water rights, \*Legal aspects, Jurisdiction, \*Federal jurisdiction, \*State jurisdiction, \*Federal-state water rights conflicts, Irrigation, Pueblo water rights, Water law, Constitutional law, Arid lands, North Dakota, South Dakota, Montana, Idaho, Washington, Federal Government, State governments, Public rights.

This article discusses the police power of the states in connection with Indian Reservations and Indian water rights. Particular concern is focused on the arid and semi-arid Western States. After examining the legal history of Indian rights, the author concludes that the police power of the States may not be extended to affect Indian water rights. Several reasons support this conclusion: (1) the unbroken line of decisional law; (2) the will of Congress expressed in the Enabling Acts admitting Western States into the Union; (3) the Constitutional disclaimers imposed as conditions to state admission (under which the States renounced all claims to Indian lands); and (4) the overriding Trust obligation of the United States to preserve and protect the 'Indian Winters Doctrine' rights to the use of water in the arid and semi-arid West. The author states that the primary reason for the violation of Indian rights by the States has been the avidity for water in the Western States and the failure of the United States to prevent those violations. (Nursey-Florida)

'IT'S OUR WATER'--CAN WYOMING CON-STITUTIONALLY PROHIBIT THE EXPORTA-TION OF STATE WATERS, Wyoming Univ., Laramie. Water Resources

Wyoming Univ., Laramie. Water Resource Research Inst. G. A. Zunker.

Land and Water Law Review, Vol 10, No 1, p 119-146 (1975). 28 p, 156 ref. Descriptors: \*Wyoming, \*Legislation, \*Interstate compacts, \*Water rights, \*Judicial decisions, Regulation, State governments, Water contracts, Water utilization, Interstate, Water users, Water allocation(Policy), Federal government, Permits, Legal aspects, Jurisdiction, Constitutional law, Water, Water law. Identifiers: \*Wyo. Stat. S 41-10.5, State policy.

A 1974 Wyoming Statute designed to preserve the state's waters for its inhabitants prohibits the exportation of Wyoming waters without specific authorization by the state legislature. This article examines the constitutionality of that statute. Currently there are two divergent views of water as a natural resource. One gives a state virtually un-limited control over its water where interstate commerce is involved. The other treats water like any other natural resource and does not permit the state to restrict its use in interstate commerce to any greater degree than is permitted for other natural resources. Most arguments in support of statutory restrictions which have been placed upon the use of water outside the state are based on the concept that all property interest in the waters of the state is vested in the state. Counter arguments, however, say the issue is not one of property or ownership, but of accommodating the competing demands of the state and national interests involved. (Parrish-Florida)

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HOW NOW BROWN COW: REGULATION OF FEEDLOT POLLUTION IN WISCONSIN, Harvard Law School, Cambridge, Mass. For primary bibliographic entry see Field 5G. W76-03590

LAW OF THE SEA - EXCLUSIVE ECONOMIC ZONE (DISCUSSION OF FISHERIES JURISDICTION CASE), J. G. Weil.

Harvard International Law Journal, Vol 16, No 16, p 474-490, (1975). 7 p, 64 ref.

Descriptors: \*Law of the Sea, \*Commercial fishing, \*Boundary disputes, Foreign countries, \*Foreign waters, Jurisdiction, Treaties, Foreign trade, Legal aspects, Economic impact, Income benefits, Government finance, Natural resources, Fish conservation, Fish management, Political aspects, Governments, Governmental interrela-

Identifiers: \*Iceland, \*United Kingdom, \*Fisheries jurisdiction, Doctrine of preferential rights.

The Fisheries Jurisdiction Case developed from a dispute between the United Kingdom and Iceland over fishing rights in waters adjacent to the Icelandic coast. The dispute was touched off when Iceland announced its intention to extend its exclusive fisheries jurisdiction to 50 nautical miles. In 1974 the International Court of Justice accepted jurisdiction of the dispute. The court focused on two issues: whether Iceland's unilateral extension of its exclusive fisheries jurisdiction in violation of a 1961 agreement was valid against the United Kingdom; and whether Iceland and the United Kingdom are under a mutual duty to negotiate a conservation regime to protect the limited resources in the disputed waters. The vehicle used by the Court to resolve these issues was the newly developed doctrine of preferential rights. The functional substance of this doctrine must be developed through negotiations by the disputants themselves. In this case, the Court instructed the negotiating parties to consider the preference due Iceland as a coastal state, the United Kingdom's time-honored economic interest in the area, and the interests of the entire world in the conserva-tion of resources. (Hoffman-Florida) W76-03591

UNITED STATES ENVIRONMENTAL LAWS AND EXPLORATION AND PRODUCTION OPERATIONS, Atlantic Richfield Co., Dallas, Tex. North Amer-

rican Producing Div.
For primary bibliographic entry see Field 5G.
W76-03592

MODERNIZING STATE WATER RIGHTS SOME SUGGESTIONS FOR NEW LAWS: SOM DIRECTIONS.

California State Water Resources Control Board, Sacramento.

R. B. Robie. Utah Law Review, Vol 1974, No 4, p 760-784 (1974). 25 p, 129 ref.

Descriptors: \*Water resources development, \*Water rights, \*State jurisdiction, \*Water allocation(Policy), \*Administrative decisions, Legal aspects, Water law, Administrative agencies, Administration, Planning, Water policy, Stream flow, Surface waters, Water resources, Subsurface waters, Social impact, Management, Long term planning.

Identifiers: \*Public interests, Water rights institu-

Modernization of water rights institutions will mean more extensive state involvement and dis-cretion in the allocation of water. Any suggested changes must rest on three general principles: (1) water rights laws must recognize public needs and social goals; (2) water rights administration must involve planning for the total water resource; and (3) the system must maximize water conservation. Examined here are suggested changes in laws in various areas, including: maintenance of minimum streamflows; provisions for public access to water resources; broadening the concept of 'public inresources; or vaceting a broadly based water resources plan to guide in the allocation of water resources; establishing a single legal system for surface and underground water; making a full environmental analysis a part of every states 'water rights law; and making water rights sufficiently flexible to provide for changing public values and conditions. One change proposed in the administrative area would provide procedures for op-timum allocation of the total water resource thereby assuring that the water appropriated is used to its maximum efficiency. (Hoffman-Florida) W76-03593

A NEW APPROACH TO INTERNATIONAL ENVIRONMENTAL COOPERATION; THE NATO COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY,

Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G. W76-03594

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WPCF LOOKS AT WATER CLEANUP PROBLEMS AND PROSPECTS. For primary bibliographic entry see Field 5G. W76-03596

NEW CLASSIFICATIONS ADOPTED AND ASSIGNED TO CERTAIN WATERS IN THE YAD-

mission, Raleigh.
For primary bibliographic entry see Field 5G.
W76-03598 North Carolina Environmental Management Com-

ORDINANCE AMENDING THE COMPREHEN-SIVE ZONING ORDINANCE NO. 3011 (FOR FLOOD HAZARD PROTECTION, FORT WORTH, TEXAS).

Fort Worth, Tex. For primary bibliographic entry see Field 6F. W76-03599 INDIANA DUNES NATIONAL LAKESHORE (S 820).

Hearing--Subcomm on Parks and Recreation Comm on Interior and Insular Affairs 93d Cong 2d Sess, Sept 30, 1974. 298 p, multi photo.

Descriptors: \*National Lakeshores, \*United States, \*Seashores, \*Conservation, Legal aspects, Water law, Competing uses, Economics, Water ronservation, Natural resources, National Parks, Protection, Water resources development, Water quality, Water quality, Water for feet, Land use, Economic impact, Social aspects, Water utilization Indiana.

tion, Indiana.

Identifiers: \*Indiana Dunes National Lakeshore, Senate Subcommittee on Parks and Recreation, Congressional hearings.

Considered here is a proposed amendment to the act establishing the Indiana Dunes National Lakeshore. The amendment would provide for the addition of approximately 5230 acres to the lakeshore. Testimony includes statements from Senators Bayh, Hartke and Percy, three of the Bill's sponsors, and from environmental and con-servation groups, in favor of the amendments and from business and farming groups generally op-posed to the amendment. A letter from the Depart-ment of the Interior states the Department's position that the addition of acreage to the lakeshore is not of national significance nor necessary for the primary purpose of the lakeshore; and furthermore, there is already a great existing demand for funds to acquire areas previously authorized in the National Park System. (Nursey-Florida)

STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY--PROPOSED EF-FLUENT LIMITATIONS GUIDELINES AND STANDARDS.

Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G. W76-03601

MEAT PRODUCTS POINT SOURCE CATEGO-RY--SMALL PROCESSOR SUBCATEGORY; EF-FLUENT LIMITATIONS AND GUIDELINES Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G. W76-03602

MEAT PRODUCTS AND RENDERING PROCESSING POINT SOURCE CATEGORY-EFFLUENT GUIDELINES AND STANDARDS. Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G. W76-03603

GRAIN MILLS MANUFACTURING POINT SOURCE CATEGORY--EFFLUENT LIMITA-TIONS AND GUIDELINES.

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G. W76-03604

PLANNING ASSISTANCE TO STATES (TO AID IN PREPARATION OF COMPREHENSIVE PLANS FOR WATER AND RELATED FOR RESOURCES).

Corps of Engineers, Washington, D.C. For primary bibliographic entry see Field 6B. W76-03605

INTERVENTION ON THE HIGH SEAS ACT. PL 93-248; 88 stat 8, US Code Cong and Admin News, p 9-12, 1974, 4 p.

Descriptors: \*Disasters, \*Navigation, \*Oil spills, \*Legislation, \*Federal jurisdiction, Comprehensive planning, Governmental interrelations, Water pollution effects, Environmental effects, Aquatic life, Wildlife, Oil wastes, Oily water, Oil, Water pollution sources, Decision making, Law enforcenent, Penalties(Legal), Oil pollution, Hazards,

Identifiers: \*Intervention on the High Seas Act, \*Liability

Whenever a ship collision or other incident of navigation creates a grave and imminent danger of oil pollution to the coastline or related interests of the United States, the Secretary of the department in which the Coast Guard is operating may take such measures on the high seas are necessary to prevent, mitigate, or eliminate that danger. Furthermore, any action so undertaken shall be without liability for any damage to the owners or operations of the ship, to her cargo or crew, or to underwriters or other parties interested therein. In determining if there is a grave danger the Secreary shall consider such interests as fish, wildlife, estuarine activities, and public and private shorelines and beaches. Procedures are laid down for implementing any type of action under this Act. However, the Secretary is authorized in cases Act. However, the Secretary is authorized in cases of extreme urgency to take necessary action without any type of notification or prior consultation is required by normal procedure. Civil and criminal penalties are provided to aid in the enforcement of this Act. (Hoffman-Florida) W76-03606

UNITED STATES V. SMITH (DREDGING AND FILLING MARSHLAND WITHOUT CORPS OF ENGINEERS PERMIT). 5 ELR 20382-20383 (ED Va. 1975), 2 p.

Descriptors: \*Rivers and Harbors Act, \*Dredging, \*Wetlands, \*Landfills, \*Federal Water Pollution Control Act, Permits, Tidal effects, Navigable waters, Bulkheads, High water mark, Marshes, Federal jurisdiction, Environmental effects, Penalties(Legal), Streams, Construction, Tidal waters, Judicial decisions, United States.

Defendent landowner had dredged a creek, filled in marshlands adjacent to his property, and con-structed a bulkhead below the mean high water line without a permit from the Corps of Engineers. Because no permit was obtained, the United States brought this action for injunctive relief and civil penalties pursuant to the Rivers and Harbors Act of 1899 and the 1972 Amendments to the Federal Water Pollution Control Act. The court found it had jurisdiction over the subject matter and the parties to the action by virtue of findings of fact that Stutts Creek is a navigable water of the United States. Since the creek was a navigable onited States. Since the creek was a navigable water, the dredging and construction of a bulkhead constituted a violation of the Rivers and Harbors Act of 1899. The marsh wetlands were found to be 'water of the United States' under the 1972 Amendments to the FWPCA because they were, under normal conditions, inundated by the tides.
Thus the defendant's landfill activities constituted a discharge into the 'waters of the United States' in violation of 301 and the 1972 Amendments. Consequently, the court granted appropriate injunctive relief. (Hoffman-Florida) W76-03607

UNITED STATES V. SEXTON COVE ESTATES, INC. (ORDER REQUIRING DEVELOPER TO RESTORE WETLAND MODIFIED WITHOUT CORPS OF ENGINEERS PERMIT). 5 ELR 20348-20353 (SD Florida, 1975), 6 p.

Descriptors: \*Florida, \*Rivers and Harbors Act, Descriptors: 'Florida, 'Rivers and Harbors Act, 'Canala, 'Navigable waters, 'Canal construction, Judicial decisions, Water permits, Water law, Penalties(Legal), Tidal waters, Mangrove swamps, Inland waterways, Navigation, Water rights, Governments, Legal aspects. Identifiers: Private property.

### Field 6-WATER RESOURCES PLANNING

### Group 6E-Water Law and Institutions

In an action brought under the River and Harbors In an action brought under the River and Harbors Act of 1899, the court ordered a developer who commenced canal building and modification without a Corps of Engineers permit to restore pre-existing canals, plug and fill in canals it constructed, and replant the manager of the pactical department and the backers of the activated canals. The never held the banks of the restored canals. The court held that man-made canals on private property become navigable waters of the United States and thus subject to the Act's permit requirements when connected to tidal water, even if they are sub-sequently plugged at their seaward ends. The court also held that a canal is a 'structure' within the meaning of the statutory provision authorizing in-junctive relief to prevent the construction or seek interverteil to prevent unconstruction of seek the removal of an unlawful structure. Neither equitable estoppel nor laches precluded the government from enforcing that statute by seeking such relief in this case. The developer was enjoined from selling any property at the develop-ment site without the prior approval of the court until the mandate restoration has been accomplished. (Hoffman-FLORIDA)
W76-03608

CHICAGO REGIONAL PORT DISTRICT ACT. Ill Ann Stat ch 19 sect 152 thru 178 (Smith-Hurd),

Descriptors: \*Port authorities, \*Illinois, \*Administrative agencies, \*Administrative deci-\*Illinois, Descriptors: sions, \*Legislation, Economics, Regulation, Legal review, Water policy, Water managereview, Water policy, Water manage-ment(Applied), Bond issues, Financing, Adminis-tration, Water resources development, Navigation, Ships, State governments, Standards, Costs, Adoption of practices.
Identifiers: \*Port districts, Economic controls.

This Act creates the Chicago Regional Port Districtand confers upon it specified duties, rights and powers. The Act also provides procedures and rules which must be followed concerning the operation of public warehouses and other storage facilities owned and controlled by the District. Economic controls are put on the District in that it can not incur any oblications until the necessary appropriations have been made. In order to facilitate orderly operations, the District is given the power to make any transactions concerning real property that are necessary to the develop-ment of the port area. Because of the large amount of capital needed to run the port, the District is also given the power to issue bonds to finance required purchases. The Act makes it clear, how-ever, that such bonds shall not become obligations of the State of Illinois. The Act also details regulations governing the administrative operations of the Chicago Regional Port District Board. Finally, the Act provides that all final administrative decisions of the Board will be subject to judicial review. (Hoffman-Florida) W76-03609

PEOPLE OF CALIFORNIA EX REL. STATE WATER RESOURCES CONTROL BOARD V. ENVIRONMENTAL PROTECTION AGENCY (ACTION TO REQUIRE EPA TO NOT EXEMPT FEDERAL AGENCIES FROM PERMIT PROCEAMS).

511 F2d p 963-975, (9th Circuit 1975), 16 p.

Descriptors: \*State jurisdiction, \*Federal Water Pollution Control Act, \*Washington, \*California, \*Judicial decisions, Governmental interrelations, Legislation, State governments, Permits, Legasapects, Water law, Federal jurisdiction, Environmental effects, Regulation, Clean Air Act, Water pollution, Water pollution control, Water pollution sources, Control.

Identifiers: Federal Water Pollution Control Act Amendments of 1972, Federal agencies, State policy, Administrative regulations.

Appellants, state governments, appealed from decision of appellee, Administrator of the Environmental Protection Agency (EPA), to exempt federal agencies from compliance with state permit programs regulating pollution control. Under the Federal Water Pollution Control Act (FWPCA), state governments assume primary responsibility for implementation of the National Pollutant Discharge Elimination System. The EPA Administrator exempted federal facilities, which discharge pollutants into navigable waters, from compliance with any state permit program. The Ninth Circuit Court of Appeals held this to be error, concluding that federal agencies are required to comply fully with all aspects of state water pollution permit programs. In finding a Con-gressional intent to subject federal facilities to state regulation under the FWPCA, and to rely on state governments to enforce the Act, the court directed the EPA Administrator to reconsider the applications of the appellant states, to the extent he previously rejected their proposed programs. (Jenkins-Florida)

SPRINGER V. JOSEPH SCHLITZ BREWING COMPANY (DIVERSITY ACTION BY OWNERS OF DOWNSTREAM FARM ALLEGING DISCHARGE INTO MUNICIPAL TREATMENT FACILITY WHICH CAUSED OVERLOAD AND

510 F 2d p 468-479, (4th Circuit 1975), 12 p.

Descriptors: \*North Carolina, \*Judicial decisions Negligence, "Penalties(Legal), "Municipal wastes, Local governments, Riparian rights, Industrial wastes, Wastes, Waste, Waste pollution, Water pollution sources, Rivers, Waste disposal, Waste treatment, Waste water(Pollution), Waste water treatment, Water pollution effects, Legislation. Identifiers: Injunctive relief, Immunity.

Plaintiff, downstream riparian landowners, sued in federal district court for injunctive and monetary rederal district court for injunctive and monetary relief for defendant brewery's discharge into a mu-nicipal treatment facility. The discharge allegedly overloaded the city's sewage treatment plant, causing pollution of a river bordering plaintiff's property. In a case of first impression, the Fourth Circuit Court of Appeals held that the violation of a municipal sewage ordinance can subject industrial sewage sources to a private tort action. Failure to obtain a permit for waste discharge is not actionable without proof that the discharge contained a prohibited level of pollution and that such pollution proximately caused damage to riparian rights. Both issues are for the jury to decide. The court also ruled that where the industrial user knows or has reason to know that municipal facilities cannot adequately treat its waste, the general rule that a user is immune from prosecution because of the city's negligence does not apply. Under state law, an employer is liable for the negligent acts within his control even where an independent contractor is also at fault. The case was remanded for a new trial on both theories of liabilities. knows or has reason to know that municipal facility. (Jenkins-Florida) W76-03611

NATURAL RESOURCES DEFENSE COUNCIL, INC. V. TRAIN (ACTION BY ENVIRONMEN-TAL GROUP TO COMPEL PUBLICATION OF EFFLUENT GUIDELINES BY THE ENVIRON-

MENTAL PROTECTION AGENCY).
510 F 2d p 692-731 (District of Columbia Circuit

Descriptors: \*Judicial decisions, \*Environmental control, \*Pollutants, \*Administrative agencies, \*Regulation, Administrative decisions, Jurisdiction, Legal aspects, Legislation, Legal review, En-vironmental effects, Environmental engineering, Administration, Law enforcement, Water pollu-tion, Water pollution sources, Water pollution

Identifiers: Injunctive relief, Natural Resources Defense Council, Federal Water Pollution Control Act Amendements of 1972, Point-source pollution, Administrative regulations, Effluent limitations.

Plaintiff, Natural Resources Defense Council, sued in federal district court to compel defendant, sued in federal district court to compel defendant, Environmental Protection Agency and its Ad-ministrator, to publish effluent limitation guidelines required by section 304 (b)(1)(A) of the 1972 Federal Water Pollution Control Act Amend-ments. Defendant appealed from an adverse judgement, arguing that the deadline for publica-tion of guidelines did not include all categories of period to the compellation of guidelines and publication of guidelines did not include all categories of the compellation of guidelines and publication but only those specified in point-source pollution, but only those specified in section 306 (b)(1)(A). Defendant also argued that plaintiff's failure to comply with the notice requirement of the private citizen's suit provision was a fatal jurisdictional defect. The Circuit Court held that failure to give notice did not defeat plaintiff's claim. Neither the general federal question statute not the Administrative Procedure Act require prior notice to the administrator. The court affirmed the lower court's order that guidelines for all point-source pollutants be published within a year, but modified the order to allow the Administrator to petition for an extension of the deadline should publication of a particular category by that date be infeasible. (Jenkins-Florida) W76-03612

PEOPLE V. TEXACO, INC. (SUIT CHARGING VIOLATION OF COUNTY FIRE PROTECTION ORDINANCE IN UNLOADING GASOLINE BARGE IN NAVIGABLE WATERS). 365 NY S2d 661-670 (District Court, Nassau Coun-

tv. 1975), 10 p.

Descriptors: \*Navigable waters, \*Governmental interrelations, \*Tidal waters, \*State jurisdication, Judicial decisions, Regulation, Penalties(Legal), Legislation, Harbors, Water policy.

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Defendant was charged with violating a county fire prevention ordinance concerning unloading gasoline from his barge. One of the issues at trial was whether the Nassau County fire marshall had jurisdiction overs water contiguous to the county. The court found that title to tidal waters has always been vested in the sovereign for the common good. The state legislature thus had the preroga-tive to confer upon local municipalities the right to regulate their abutting navigalbel and tidal waters. The court found that such a right was conferred upon Nassau County under section 2 of the Navigation Law. Since the county had the right of regulation, it had the authority to provide requirements and penalties with respect to activities on the navigable water. (Hoffman-Florida) W76-03613

HACKENSACK WATER COMPANY V. JUZEK (APPEAL FROM CONDEMNATION LANDOWNER'S PROPERTY FOR CONSTRUCTION OF WATER RESERVOIR). 333 A2d p 544-552 (Superior Court of the New Jer-

sey, 1975), 9 p.

Descriptors: \*New Jersey, \*Condemnation, \*Easements, \*Flooding, Water law, Legal aspects, State governments, Administrative agencies, Flood damages, Dams, Reservoirs, Reservoir construction, Water storage, Compensation, Eminent domain, Legal review, Project planning, Bodies of water, Flood frequency.

Identifiers: \*Dam effects, Administrative regula-

Appellant water company sought approval for condemnation of respondent landowner's property, to construct a water reservoir. The application was approved in part and denied in part by respondent water policy and supply council, which ruled that respondent landowners should grant appellant an easement for periodic flooding of a portion of respondent's property. The water company argued that the council's findings of fact were inadequate and unsupported by the evidence. The Superior Court of New Jersey, Appellate Division, held that the council has implied authority to sanction con-

### WATER RESOURCES PLANNING-Field 6 Water Law and Institutions—Group 6E

demnation of an easement, rather than a fee interest, where chronic, serious, or frequent flood-ing is unlikely. Occasional or periodic flooding may constitute an injury to land rather than a permanent taking or appropriation. However, such injury must be redressed through an award of just compensation. Thus, the court ruled that conditioning approval upon the landowners' execution of an agreement to hold appellant harmless from damages for flooding was improper. (Schilling-Florida) W76-03614

DEPARTMENT OF NATURAL RESOURCES V. CROPPER (ACTION TO ENJOIN CONSTRUCTION OF HOUSE BETWEEN MEAN HIGHWATER LINE AND DUNE LINE). 332 A2d p 644-646 (Court of Appeals of Maryland

1975), 3 p

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Descriptors: \*Maryland, \*Prescriptive rights, \*Beaches, \*Land use, State governments, Ad-ministrative agencies, Water law, Legal aspects, Dunes, Coasts, High water mark, Land resources, Judicial decisions, Public rights, Public access,

Identifiers: \*Dedication, Injunctive relief, State policy, Evidence.

Plaintiff Department of Natural Resources brought action to enjoin defendant landowner from constructing a house in the dry sand area of an ocean front tract between the mean high water line and the dune line. The Department argued that the area between the mean high water line and the dune line has been dedicated to the public, and that the public had attained prescriptive rights to the area. The trial court dismissed the bill of complaint, pointing out that defendant held permits from the appropriate city and county authorities. The Court of Appeals of Maryland affirmed, holding that there had been no dedication of the property in question, since there was no evidence of an intention to dedicate. Since there was no evidence of continued and uninterrupted adverse use for twenty years, the court denied plaintiff's claim that the public had acquired prescriptive rights. (Schilling-Florida) W76-03615

NUECES COUNTY DRAINAGE AND CONSERVATION DISTRICT NO 2 V. BEVLY (SUIT TO ENJOIN ENLARGEMENT OF EXISTING

DRAINAGE DITCH).
519 SW 2d, p 938-953 (Court of Civil Appeals of Texas, 1975), 16 p.

\*Texas, \*Eminent domain, law, \*Channel improvement, Descriptors: \*Texas, \*Eminent domain, \*Constitutional law, \*Channel improvement, \*Flood damge, Local governments, Administrative agencies, Water law, Legal aspects, Drainage, Flood routing, Floods, Drainage systems, Channels, Erosion, Ditches, Common law, Water management(Applied), Judicial decisions. Identifiers: Sovereign immunity, Injunctive relief. Descriptors:

Plaintiff landowner sought to permanently enjoin the enlargement of an existing drainage dich, located partly within the defendant drainage and conservation district. Plaintiff contended that enlarging the ditch would irreparably damage his land through increased flooding and erosion. The trial court granted injunctive relief on the ground trial court granted injunctive relief on the ground that enlarging the ditch would result in the 'taking' of plaintiff's property in violation of the Texas constitution. The court of civil appeals reversed, holding that the ditch enlargement did not constitute a 'taking' of plaintiff's property since there would be no physical invasion or appropriation of the land. Thus, any injury to plaintiff's property would be a 'damaging' rather than a 'taking' in the constitutional sense. The court stated that even though the district could not exercise eminent domain to appropriate land outside its boundaries. domain to appropriate land outside its boundaries, it could make improvements which might damage such land. Where the proposed ditch improvement

was permanent and lawful, it could not be en-joined. Rather, plaintiff was limited to damages as a remedy. (Schilling-Florida) W76-03616

DEPARTMENT OF NATURAL RESOURCES V. LINCHESTER SAND AND GRAVEL CORP (APPEAL BY LANDOWNER FROM DENIAL OF PERMIT TO DREDGE AND FILL PRIVATE

WETLANDS).
334 Atlantic Reporter, 2 d Series, p 514-526 (Court of Appeals of Maryland, 1975), 13 p.

Descriptors: \*Maryland, \*Wetlands, \*Constitutional law, \*Administrative agencies, Adjudication procedures, Dredging, Permits, Judicial decision, Legal review, Administration deci-sions, Legislation, Administration, Legal aspects, Water, Water law, Environmental effects. Identifiers: Administrative law, Fill permits.

Landowner's application for a dredging permit on private wetlands was denied by the Secretary of the Department of Natural Resources (DNR) and the denial was affirmed by the Department board of review. The landowner then appealed the board's decision to the circuit court pursuant to Maryland's 'wetlands statute' which provides a de maryiand's wearans statute which provides a de-novo jury trial. At trial the jury was permitted to determine the ultimate quesion of whether the per-mit should be granted. From a decision granting the landowner a permit, the DNR appealed, con-tending that the scope of judicial review allowed by the statute was an unconstitutional usurpation of the traditional division of powers between the legislative and judicial branches. The Court of Appeals remanded the case, holding that the section providing for a de novo trial was unconstitutional. The court held that when an administrative agency is acting in a fact-finding capacity, the courts review is limited to determining whether the deci-sion was rendered in an illegal, arbitrary, capricious, oppressive or fraudulent manner. Under the Maryland statute, the scope of review was imper-missible since it allowed the court to substitute its own judgement for that of the agency. (Hoffman-Florida) W76-03617

HOLIDAY INNS, INC. V. POLLUTION CONTROL BOARD (PETITION FOR REVIEW OF ORDER DENYING VARIANCE FROM WATER POLLUTION RELATIONS REGARDING EF-327 NE2d, p 364-368 (5th DCA Illinois, 1975), 5 p.

Descriptors: \*Illinois, \*Sewage effluents, \*Waste water disposal, \*Water quality standards, Judicial decisions, Sewage disposal, Environmental sanitation, Sewage treatment, Regulation, Wastes, Water pollution sources, Water pollution, Disposal, Public health, Water, Water law, Legal

aspects, Environmental effects.

The petitioner operates a motel complex in a sparsely population area. Petitioner's application for a variance from water pollution regulations regarding effluent standards was denied by the Pollution Control Board (PCB). The petitioner appealed that decision, contending it was arbitrary and capricious. The petitioner relied on the fact that it was proceeding with reavenable speed to construct an proceeding with reasonable speed to construct an adequate pollution treatment facility. In reviewing the order of the PCB, the court noted that it was required to sustain the order if it was supported by creditable evidence. The court also observed that petitioner's argument that no public hazard was involved because of the motel's location, and that an effort to comply with regulations was in progress, would be appropriate to an enforcement proceeding. Despite these two observations, the court dismissed the appeal, finding the issue to be moot, since the period of time for which the variance could have been greated had expired (Viffee). could have been granted had expired. (Hoffman-Florida)

FISHING REEFS IN OFFSHORE WATERS. Alabama Code, Tit 8, Sections 171(23)-171(25) (Cum Supp 1973), 2 p.

Descriptors: \*Fishing, \*Reefs, \*Alabama, Marine fisheries, \*Mississippi, \*Florida, Federal government, Salvage value, Conservation, Marine fish, Resources, Resource development, Public benefits, Water, Water law, Legal aspects, Legislation, Governmental interrelations.

Identifiers: \*Artificial reefs, \*Liberty ships, Coastal waters, Offshore waters.

The federal government made available to the states of Alabama, Mississippi and Florida fifteen liberty ships for the purpose of establishing artificial fishing reefs in the states' coastal waters. This part of the Alabama code provides that the money realized from any salvagable parts of the vessels shall be used by the division of marine resources in preparing the vessels for submersion. It further creates a fishing reef ship commission and pro-vides that the commission members be reimbursed for their actual expenses while conducting the business of the commission. (Parrish-Florida)

INNOCENT PASSAGE: AN HISTORICAL AND ANALYTICAL PERSPECTIVE, North Carolina Univ. at Chapel Hill.

In: Some Current Sea Law Problems, Sea Grant Publication UNC-SG-75-06, p 1-13, Feb, 1975, 13

Descriptors: \*Law of the Sea, \*International law, \*Straits, \*Navigation, \*Foreign waters, Military aspects, International waters, Law enforcement, Jurisdiction, Governments, Foreign countries, Governmental nterrelations, Ships, Conferences, Posticia Navigative Construction Routing, Navigation, Coasts.
Identifiers: \*Innocent passage(Navigation), Terri-

Innocen passage is the right granted to certain maritine vessels freely to navigate the sovereign territorial sea of another state, as long as the passage imposes no undue harm upon the littoral state. This unrestricted right is granted only to commercial vessels, warships being subject to considerable restrictions and limitations. The passage must be one of continuous navigation and does not include putting into port. The historical basis and development of the concept of innocent passage is traced from its beginnings in ancient maritime commerce through the recent interna-tional law of the sea conferences. The sections pertaining to innocent passage in the Hague and Geneva conventions are closely analyzed to illu-minate their respective strengths, weaknesses, and areas of possible future conflicts. The major problem area inhibiting the international codifica-tion of territorial sea boundaries, that of guarantool territorial sea boundaries, that of guaranteed commercial and military passage through maritime straits, is outlined here along with other issues to be debated in the next Law of the Sea Conference. (Hoffman-Florida) W76-03620

THE U.S. POSITION ON THE BREADTH OF THE TERRITORIAL SEA: NATIONAL SECURI-TY AND BEYOND, North Carolina Univ. at Chapel Hill.

In: Some Current Sea Law Programs, Sea Grant Publication UNC-SG-75-06, Feb, 1975. 12 p, 68 ref, p 14-25.

Descriptors: "Military aspects, "Law of the Sea, "International law, "Federal jurisdiction, "Straits, Judicial decisions, Water law, International waters, Foreign countries, Ships, Navigation, Governments, Governmental interrelations, Jurisdiction, Channels, Inland waterways, Conferences, Foreign waters, Legal aspects, Political aspects, Coasts.

### Field 6-WATER RESOURCES PLANNING

### Group 6E-Water Law and Institutions

Identifiers: \*Territorial sea, Innocent passage, Free passage(Navigation), Coastal states

Since 1793 the United States has recognized a distance of three geographical miles as the extent of the breadth for the territorial sea. The Anglo-Norwegian Fisheries Case undermines the U.S. position. That case is interpreted as encouraging all states to determine for themselves within reasonable limits the width of their own territorial zones. Why the United States continues to cling to the three-mile breadth when most other nations have expanded their jurisdiction is not clear. The major motivation behind United States policy seems to be national security. If a twelve-mile breadth was recognized, coastal states that felt their security threatened could cripple the passage of United States forces through vital international straits, and be completely within their rights under international law. In 1970, President Nixon outlined proposals that provided for a twelve-mile ter-ritorial sea, a right of unimpeded transit for all ships, and unimpeded overflight for all aircraft, through and over international straits. These proposals were submitted at the 1974 Caracas Law of the Sea Conference. A group of coastal states bordering on important international straits of-fered alternate proposals that would allow them to regulate the passage of nuclear powered ships and to continue to require notification for the transit of No acceptable compromise warships. eached. (Hoffman-Florida) W76-03621

#### STARE DECISIS IN THE DEVELOPING LAW OF THE SEA,

North Carolina Univ. at Chapel Hill.

D. H. Rogers.

In: Some Current Sea Law Problems, Sea Grant Publication, UNC-SG-75-06, p 53-64, Feb 1975. 8 p. 46 ref.

Descriptors: \*Law of the Sea, \*International Law, \*Legal review, \*Judicial decisions, Water law, Law enforcement, Foreign water, Treaties, Legal review, Legal aspects, International commissions, International waters, Regulation, Governments. Identifiers: \*Stare decisis, \*International Court of Justice(ICJ).

Legal stability, one of the attributes stemming from the principle of stare decisis, is urgently needed in the emerging law of the sea. Much of this stability will be achieved through an elabora-tion of conventional international law. The International Court of Justice (ICJ) at the Hague, will also play a vital role in providing stability. Four different cases have been fully or partly resolved by the ICJ, which, when taken together, begin to establish a rudimentary body of case law in this area. They are the Fisheries Cases of 1951; The Minquiers and Ecrehos Case of 1953; The North Sea Continental Shelf Cases of 1969; and The Fisheries Jurisdiction Case of 1974. Article 59 of the ICJ Statutes states that '(T)he decision of the Court has no binding force except between the parties and in respect of that particular case.' Nevertheless, the in-depth analysis provided of the four above cited cases suggests that the seed of the doctrine of stare decisis has been implanted in the minds of the judges of the ICJ. (Hoffman-Florida) W76-03622

### THE EMERGENCY MARINE FISHERIES PRO-TECTION ACT OF 1974, S 1988, North Carolina Univ. at Chapel Hill.

R. W. Burris.

In: Some Current Sea Law Problems, Sea Grant Publication UNC-SG-75-06, p 65-73, Feb 1975. 9 p,

Descriptors: \*Marine fisheries, \*Fisheries, \*Commercial fishing, \*International law, \*Fish management, \*Federal jurisdiction, Legislation, Fish harvest, Aquatic environment, Foreign countries, Aquatic animals, Fishing, Fish stocking, Fish conservation, Fish reproduction, Governmental interrelations, Governments, Jurisdiction, International waters, Boundary disputes.

Identifiers: \*Haddock, \*Fishery jurisdiction, Tuna, Territorial sea.

The proposed Emergency Marine Fisheries Protection Act of 1974 (EMFPA) is largely a response to the depletion of a number of coastal and anadromous fishery stocks by foreign fishing in-terests. For example, The Russian fishing fleet in just one year of systematic concentration on the haddock reduced a strong commercial class of fish to the point that breeding stocks are feared incapa-ble of proper repopulation. Consequently, the pri-mary purpose of the 1974 Act is to unitaterally exmary purpose of the 12/4 Act is to unhacterally ex-tend U.S. fishery jurisdiction from twelve miles to two hundred miles pending a general agreement at the United Nations Law of the Sea Conference establishing an effective international regulatory regime. There has been strong opposition to this proposed Act, however, from the State Department, the Pentagon, the tuna industry and other in-ternationalists. These critics stress that unilateral action is not the appropriate solution as it would merely trigger an ineffectual round of diplomatic exchanges and reciprocal unilateral actions. They also fear that the legislation could prove detrimental to certain U.S. fishing interests by placing the U.S. in a possible confrontation with nations embracing the right to fish in high seas areas. (Hoffman-Florida) W76-03623

#### INLAND BOUNDARIES OF A STATE'S ZONE.

National Oceanic and Atmospheric Administra-tion, Rockville, Md. Office of Coastal Zone agement.

In: Boundaries of the Coastal Zone, Memoran-dum, Rockville Maryland, May 20, 1975. 8 p, 17

Descriptors: \*Coasts, \*Boundaries(Property), \*Surveys, \*Comprehensive planning, Classification, Management, Legal aspects, State jurisdiction, Methodology, Legislation, Flood plains, Drainage systems, Bench marks, Ecosystems, Land management, Land classification, Land use,

Grants, Government finance, Coasts.
Identifiers: \*Coastal Zone Management Act of 1972, Coastal zone boundary, Coastal zone, Biophysical boundary, Land features.

The Coastal Zone Management Act of 1972 requires a state receiving program development grants to identify those boundaries of the coastal grants to identify those boundaries of the coastal zone subject to its management program. A set of principles have been developed by the office of Coastal Zone Management (OCZM) to provide guidance with regard to acceptable delineations of landward coastal zone boundaries. The OCZM has determined three approaches acceptable for delineating a state's inland coastal zone boundary; biophysical, biophysical as a base for administrative, and multiple. A biophysical boundary can be defined in terms of natural features, such as drainage basins, flood plains, dune formations, and ecosystems. The problem with this approach is that it may require expensive, time-consuming surveys to locate and designate areas correctly The biophysical as a base for administrative approach circumvents some of these problems by the designation of an inland boundary along a set of existing, easily located lineaments which approximate natural features and include all necessary land areas. The multiple boundary approach deter-mines coastal zone boundaries on the basis of the different functions and resources contained within an area, and thus can delineate boundaries which physically overlap or are adjacent to one another. (Hoffman-Florida) W76-03624

### TIDAL DATUMS AND MAPPING TIDAL BOUN-

National Ocean Survey, Rockville, Md.

W. V. Hull, and C. I. Thurlow. In: Boundaries of the Coastal Zone memorandum, Rockville Maryland, May 20, 1975, 12 p.

Descriptors: \*Mapping, \*Boundaries(Property), \*Tidal waters, \*Surveys, \*Photogrammetry, High water mark, Aerial photography, Terrain analysis, Management, Tides, Tidal effects, Methodology, Planning, Topographic mapping, Locating contours, Coasts.

Identifiers: \*Tidal boundaries, \*Tidal datum, \*Interrople of water leavation, Tidal datum, \*Interrople of water leavation, \*Interropl

Interpolated water elevation.

Determination of coastal zone boundaries is a prequisite to effective management and conserva-tion in the coastal zone. Tide characteristics, acquisition of tidal data, and the procedures and methodology employed all play important parts in mapping tidal boundaries. Tide characteristics depend not only on the position of the earth sun and moon, but also upon such factors as the configuramoon, but also upon such factors as the configura-tion of the land bordering the water area and water viscosity. Tidal data, such as mean high water, mean low water, and mean sea level can then be calculated by various arithmetic methods. Two procedures for determining the desired mean ater line are the interpolated Water Elevation (IWE) method and the photogranmetric method. An IWE may be established if the time and range differences at two adjacent tide stations are acceptably small. In photogrammetry, radio contact is maintained with a photographic aircraft by a tide observer. At the desired tidal stage, the observer tells the photographic crew to photographic the area. Detailed information of these two approaches is presented along with a discussion of various other problems which may arise in tidal boundary demarcation. (Hoffman-Florida) W76-03625

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### LEGAL ASPECTS OF TIDAL BOUNDARIES OF

THE COASTAL ZONE, National Oceanic and Atmospheric Administration, Rockville, Md.

In: Boundaries of the Coastal Zone, Memorandum, Rockville, Maryland, May 20, 1975. 15 p.

Descriptors: \*Boundaries(Property), \*Boundary Descriptors: \*Boundaries(Property), \*Boundary disputes, Coasts, \*Tidal waters, Intergovernmental relations, Legal aspects, State jurisdiction, Legislation, Comprehensive planning, Management, Multi-purpose projects, Shores, Administration, Land use, Coastal marshes. Identifiers: \*Coastal Zone Management, \*Territorial sea, \*Coastal waters.

Section 305 (b) of the Coastal Zone Management Act of 1972 requires coastal states to identify the boundaries of their coastal zones subject to the management program. For those states with coastal zones on the oceans, the seaward limit of the coastal zone is defined to be the outer limit of the United State's territorial sea. Lateral seaward limits of a state's coastal zone will be defined by the state's lateral seaward boundaries. Two procedures have traditionally been available to the states to settle boundary disputes, interstate agreements and formal legal action. The landward boundary of a state's coastal zone extends inland from the shoreline only to the extent necessary to con-trol the shorelands, the use of which have a direct and significant impact on coastal waters. One method used to determine landward boundaries having a relation to the water and the shoreline is to make the shoreline a baseline from which horizontal measurement is made inland. All such methods, together with the factual issues of how tidal datums are computed, are often in contention. A substantial amount of case law is being developed which should provide guidelines for performance in the future. (Hoffman-Florida) W76-03626

### OKANAGAN WATER DECISIONS,

Simon Fraser Univ. Burnaby (British Columbia). Dept. of Geography.

For primary bibliographic entry see Field 5G. W76-03630

FEDERAL ENVIRONMENTAL LAWS AND REGULATIONS,

Fluor Engineers and Constructors, Inc., Anaheim.

For primary bibliographic entry see Field 5G. W76-03806

WESSEX: EVOLVING WITH ITS DIVISIONS,

Water, No 5, p 13-15, October, 1975. 3 fig.

Descriptors: \*Administration, Water works, Water treatment, Planning, Local governments. Identifiers: Water Authorities(Great Britain), Wessex Water Authority.

A conversation with Kenneth Roberts, the chief executive of the Wessex Water Authority, is re-ported. The Wessex Water Authority differs slightly from the other nine WA's in its water company flavor, and its philosophy of evolution rather than revolution. Water company philosophy is reflected in the creation of the post of secretary to reflected in the creation of the post of secretary to the authority, and the handling responsibility for recreation and fisheries as an on-line function of the chief executive. Fisheries is a growth sport and also has great public relations value. The post of secretary was envisaged as a sort of father figure in the water authority's administration. The post was developed because the Wessex authority is too small to need a director of administratgion. Rather than dictate the organizational structure, the Wessex Authority has consulted with the staff in the various divisions before forming multi-func-tional divisions. Since Wessex now consists of three fairly autonomous multi-functional units, the headquarters is now considered to have a planning role rather than a day-to-day role. Advisory com-mittees have been established in each division made up of representatives of the local district councils, the CLA, the NFU, the CBI, and the Sports Council. The committees do not have executive roles, but long-term planning, mediumterm planning, and problems are brought to the committees for their reaction before they are put to the authorities for decisions. (Orr-FIRL) W76-03811

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WATER RESOURCES IN NORTHUMBRIA WITH PARTICULAR REFERENCE TO THE KIEDLER WATER SCHEME, Northumbrian Water Authority (England). Northumberland and Tyne Div. U.T. Burston, and D. J. Coats.
Journal of the Institute of Water Engineers and Scientific Vol 29. No. S. p. 26-241 | July. 1975 3

Scientists, Vol 29, No 5, p 226-241, July, 1975. 3 fig, 5 tab, 8 ref.

Descriptors: \*Water resources, \*Water resources development, Aquifers, Water demand, Reservoir sites, Water supply, Surface waters, Estuaries, Desalination, Recreation, Camping, Fishing, Boating, Economic feasibility.

Identifiers: Northumbrian River Authority, Northumbrian Water Authority, Kiedler Scheme.

The steps taken by the Northumbrian River Authority before the Northumbrian Water Authority took over to meet the future demands Authority took over to meet the trutre demands for water in the area are studied. The Kiedler Water Scheme is emphasized. The area described consists of about 3,580 sq miles, with a large population and the need for new industries. The average annual rainfall varies from about 25 inches in some areas to 90 inches in others. Industry and population tend to concentrate near the coast; therefore the possibility of the reuse of water is minimized. When the River Authority came into existence eleven water undertakings had their area of supply within the Authority area. New esti-mates of demand that the Authority made upon taking over had to consider industry, public water

supply, and direct abstractors, such as agriculsupply, and untert abstractors, such as agriculturists and industrialists who take the water out of watercourses that pass their land. Sources of supply to meet these demands that were considered included aquifiers, desalination, estuarial barrages and surface water. It was found that surface water in the form of reservoirs would be necessary to meet the demand. Different plans necessary to meet the demand. Different plans were considered and the one settled on was called the Kielder Scheme. The construction period would be five years, only one reservoir would be needed and the amount of flooding would cover half the area that the other plans would. This plan had the least cost, the most flexibility, and the most environmental and social soundness. The recreational potential was evaluated and page in recreational potential was evaluated and plans in-cluded camping sites, fishing, hiking, picnicking and sailing. (Pinto-FIRL)

NEERI ACCEPTS CHALLENGE TO REDUCE POLLUTION.

For primary bibliographic entry see Field 5D.

PUBLIC PARTICIPATION IN WATER POLLU-TION CONTROL.

Environmental Protection Agency, Atlanta, Ga. For primary bibliographic entry see Field 5G. W76-03835

ULTIMATE DISPOSAL BY MEANS OF DEEP

WELL INJECTION: A LEGAL VIEW, Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center. For primary bibliographic entry see Field 5E.

WATER RIGHTS LAWS IN THE NINETEEN WESTERN STATES, VOL 11, Economic Research Service, Washington, D. C.,

Natural Resources Economic Div. W. A. Hutchins.

W. A. Hutchus. For sale by the Supt. of Documents, GPO, Washington, D.C., 20402, Price \$10.00. Miscel-laneous Pub, No 1206, 1974. 756 p, Completed by H. H. Ellis and J. P. DeBraal.

Descriptors: \*Water utilization, \*Appropriation, \*Diversion, \*Beneficial use, Preferences(Water rights), Pacific Coast region, Legal aspects, Surface waters, Ground water, Irrigation, Judicial decisions, State governments, Administrative agencies, History, Classification, Riparian rights, Prior appropriation, Watercourses(Legal aspects), Water types, Arid lands, Real property, Remedies, California.

Identifiers: \*Western U.S. States.

Volume two compares and contrasts the development and status of water rights law in the various western states regarding: (1) the riparian doctrine; (2) the pueblo water right; (3) ancient Hawaiian water rights; (4) watercourses of various types; (5) diffused surface waters; and (6) groundwaters such as artesian and percolating waters. While the western states generally follow the rule of prior appropriation and reasonable beneficial use of water, areas of conflict among holders of the different kinds of water rights are many. Statutes and judicial decisions of the several western states in these areas are examined, as well as the power of administrative agencies to regulate the acquisition and exercise of water rights. Developments in California supply much of the material. (See also W76-02105) (Parrish-Florida) W76-03916

THE PORTS AND WATERWAYS SAFETY ACT OF 1972: AN EXPANSION OF THE FEDERAL APPROACH TO OIL POLLUTION,

Kelso, Spencer, Synder and Stirling, Honolulu, Hawaii.

For primary bibliographic entry see Field 5G. W76-03917

NEEDED: A GROUND-WATER TREATY BETWEEN THE UNITED STATES AND MEX-

For primary bibliographic entry see Field 4B. W76-03918

WATER AND WATERCOURSES—FEDERAL JU-RISDICTION—FEDERAL COMMON LAW DETERMINES OWNERSHIP OF RE-EXPOSED NAVIGABLE RIVER BEDS—BONELLI CATTLE CO. V. ARIZONA,

R. A. Hopp. Washington Law Rev, Vol 50, p 777-793 (1975). 17 p, 83 ref.

Descriptors: "Accretion(Legal aspects), "Real property, "Ownership of beds, "Federal jurisdiction, "Watercourses(Legal aspects), Navigable rivers, Running waters, Judicial decisions, Legal aspects, Common law, State jurisdiction, High water mark, Riparian rights, Beds, Land tenure, Federal-state water rights conflicts, Water rights, Water law, Boundary disputes, Bounda ries(Property).
Identifiers: \*Equal footing doctrine.

Plaintiff Bonelli Cattle Company brought a quiet title action against the State of Arizona to determine ownership of newly re-emerged land purchased by plaintiff in 1955 from a federal gran-tee. The land had been re-exposed as a result of dredging and rechanneling of part of the Colorado River. The trial and intermediate appellate courts upheld plaintiff's claim. The Arizona Supreme Court reversed, holding that the re-emergence was caused by artificial, avulsive forces. Hence, under state law, the land belonged to the state. The United States Supreme Court reversed again hold-ing that under federal common law of accretion, a state's ownership of the newly exposed bed of an inland navigable waterway is defeasible in favor of the riparian federal grantee, absent a showing by the state of any need to protect a public benefit or purpose. This note explores the pre-and post-Bonelli status of the equal footing doctrine, of state riparian property rights, and of federal com-mon law effects on those rights. The reasoning in Bonelli is examined in light of prior doctrine. The author concludes that the decision represents an unwarranted and unmanageable extension of federal law into areas previously thought reserved for the states. (Hoffman-Florida) W76-03919

WATER ALLOCATION, Stanford Environmental Law Society, Calif. For primary bibliographic entry see Field 4A. W76-03920

WATER POLLUTION, Stanford Environmental Law Society, Calif. For primary bibliographic entry see Field 5G. W76-03921

ENVIRONMENTAL LAW-1974 STYLE. For primary bibliographic entry see Field 5G. W76-03927

CORKSREW SANCTUARY: USE OF THE MARKET FOR PRESERVATION, Environmental Protection Agency, Boston, Mass. For primary bibliographic entry see Field 6G. W76-03928

THE INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES: AN EXPERIMENT IN CONSERVATION, Memorial Univ. of Newfoundland, St. John's. P. Z. R. Finkle.

### Field 6-WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

Dalhousie Law Journal, Vol 1, No 3, p 526-550 (1974). 25 p, 65 ref.

Descriptors: \*Fish management, \*Fisheries, \*Commercial fishing, \*International Joint Commission, \*Trawling, Conservation, United States, Foreign countries, Boundary disputes, Legal aspects, Regulation, International law, International waters, Coasts, Management, Ships, Ports, Adoption of practices, Technology, Biology, Fish conservation, Nets, Spawning, Administration. Identifiers: Maximum sustainable yield(Fish), International Commission for the Northwest Atlantic Fisheries(ICNAF), High seas, Mesh size(Fish nets).

The International Commission for the Northwest Atlantic Fisheries (ICNAF) was created to protect and conserve the fisheries of the Northwest Atlantic Ocean and to make possible the maintenance of a maximum sustained catch from those fisheries. In the fifteen years of its operation, the Commission has been continuously hampered by inherent flaws in its makeup. While the authority of ICNAF includes proposing fishing restrictions and regulations, each member state still retains a high degree of discretionary authority and can usually find ways of circumventing restrictions that are not to its immediate economic advantage. As for nonmember states, they are neither bound by ICNAF nor required to join, even if they fish in the ICNAF areas. Thus many ICNAF conservation measures, such as required minimum mesh sizes for trawler nets and various quota systems, have proved ineffective, resulting in the continuing depletion of many important fish species. If the Commission is to survive, it will have to develop new means for enforcing its regulations. This in turn will depend on proposals now before the Third U.N. Conference on the Law of the Sea which would significantly impair the principle of freedom of fishing on the high seas by permitting enforcement without the offending state's consent. (Parrish-Florida) W76-03929

NAVIGABLE WATERS OF THE COMMON-WEALTH OF KENTUCKY (PROPOSED WATER QUALITY STANDARDS). Environmental Protection Agency, Washington,

D.C. For primary bibliographic entry see Field 5G. W76-03930

NAVIGABLE WATERS OF STATE OF

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G. W76-03931

CRITERIA FOR THE EVALUATION OF PER-MIT APPLICATIONS (OCEAN DUMPING). Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G. W76-03932

AMENDMENTS TO ZONING ORDINACE FOR FLOOD CONTROL.

For primary bibliographic entry see Field 6F. W76-03933

FLOOD HAZARD AREAS.

Vermont State Agency of Environmental Conservation, Monpelier. For primary bibliographic entry see Field 6F. W76-03934

GUIDELINES FOR DELINEATION OF FLOOD-WAYS AND FLOOD HAZARD AREAS. Indiana State Dept. of Natural Resources, Indinanolis. For primary bibliographic entry see Field 6F. W76-03935

MODEL ZONING ORDINANCE FOR FLOOD HAZARD AREAS.

Indiana Dept. of Natural Resources, Indianapolis. For primary bibliographic entry see Field 6F. W76-03936

EASTLAKE COMMUNITY COUNCIL V.
ROANOKE ASSOCIATES, INC.
(ENVIRONMENTAL CHALLENGE TO CONSTRUCTION ON LAKESHORE).
513 P2d 36-56 (Wash 1973), 21 p.

Descriptors: "Washington, "Zoning, "Beds, "Navigable waters, "Environmental effects, Judicial decisions, Legal review, Permits, Construction, Legal aspects, Shores, Legislation, Environmental control, Reasonable use, Leases, State jurisdiction, Obstruction to flow.

Identifiers: "Environmental impact statements,

\*Building permits.

Defendant developer had used state leased sub-merged lands, which were adjacent to property on which an apartment was to be built, to satisfy zoning ordinance requirements. To prevent adverse ecological effects, plaintiff nonprofit corporations brought suit to enjoin the construction. Three of the numerous contentions urged by the plaintiffs were that: a required environmental impact state (EIS) had not been prepared; a permit had not been obtained under the Shoreline Management Act of 1971; and the apartment complex presented a obstruction to navigation. After the trial court denied injunctive relief, plaintiffs appealed to the Washington Supreme Court. The Court found that no permit was needed under the Act of 1971 since the construction had begun before the enactment of the Act. It also found that no obstruction was presented since the construction met the requirements governing private intrusions into navigable waters. The lower court decision was reversed, however, because the Court found that the building permit renewal was illegal in that no EIS had been prepared. The Court determined further that the renewal constituted a major action and thus the construction fell within the authority of the State Environmental Policy Act. (Hoffman-Florida) W76-03937

WEST V. SMITH (USE OF HOUSEBOAT IN AD-VERSE POSSESSION OF LAKESHORE CREATES EASEMENT IN GROSS AGAINST LITTORAL OWNERS). 511 P2d 1326-1334 (Idabo 1973).

Descriptors: \*Idaho, \*Littoral, \*Prescriptive rights, \*Easements, \*Shores, Adverse possession, Banks, Access routes, High water mark, Legal review, Lake shores, Public access, Navigable waters, Transfer, Water users, Water rights, Proprietary power. Identifiers: \*Injunctive relief, Presumptions(Legal).

Plaintiff littoral owner brought suit to compel defendant, owner of houseboat either to move or to pay damages amounting to \$100,000. Plaintiff contended that the houseboat constituted an undue interference with the littoral rights of lake shore property owners. Defendant, argued that the long history of the houseboat's presence at its current mooring established a prescriptive right to moor at that location. Defendant also noted that ingress and egress from the mooring site was facilitated by a public road across plaintiff's property. In affirming a denial of both injunctive relief and damages, the Idaho Supreme Court noted that a littorial owner's right of access to the lake free from all unreasonable encumberances concerns the entire shoreline; and that a houseboat permaently moored and connected to the shore does interfere

with the littoral right of access. However, the houseboat's satisfaction of the normal requirements of adverse possession creates the equivalent of an easement in gross for the houseboat to interfere with the littoral rights of the property owner. (Gray-Florida) W76-03938

NIXON V. HUTTINGA (OCCASIONAL USE OF IRRIGATION DITCH AS CONSISTENT WITH PERMISSIVE USE AS USE BY RIGHT).
518 P2d 263-65, (Mont 1973), 3 p.

Descriptors: \*Water rights, \*Montana, \*Streams, \*Ditches, \*Adjacent landowners, Contracts, Judicial decisions, Water utilization, Diversion structures, Alteration of flow, Irrigation ditches, Penalties(Legal), Real property, Water law, Irrigation water, Diversion. Identifiers: Warranty deeds.

Plaintiff landowners had brought a action seeking an injunction and damages in connection with a claimed right in an irrigation ditch running across defendent adjacent landowner's property. Plaintiffs contended that they had acquired the right in the ditch, which connected Little Bear Creek with Big Bear Creek, by virtue of a warranty deed conveying water rights in Bear Creek and appurtenant ditches. Although the ditch was in disrepair, plaintiffs were hoping to reopen it so they could divert water from Little Bear Creek to a point above their irrigation head works. At trial the district court denied the requested relief, holding that the deed granting plaintiffs a water right in Bear Creek did not give them a water right in Little Bear Creek. Plaintiffs appealed to the Montana Supreme Court. In affirming, the court recognized that a warranty deed is usually prima facie proof of good title as to the property described in the deed. In this case, however, the Court found that the deed mentioned no rights in Little Bear Creek. Since no other evidence was introduced showing such a right, the district court was correct in denying plaintiff's claim. (Hoffman-Florida)

MORRIS V. MCNICOL (DOCTRINE OF DAM-NUM ABSQUE INJURIA). 519 P2d 7-11 (Wash 1974), 5 p.

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Descriptors: \*Grading, \*Judicial decisions, \*Riparian rights, \*Lakes, \*Floods, Damages, Soils, Vegetation, Drainage, Washington, Sands, Gravels, Surface waters, Management, Pollution abatement, Shores, Control systems, Riparian land, Real property.

land, Real property.
Identifiers: Lower riparian owners, Upland
owners, Lakefront property, Platting, Statute of
limitations.

Appellant, lower riparian owner of lakefront property, brought suit for damages and affirmative relief against upland owners for damage to his property caused when a creek which emptied into the lake flooded due to the upland owners' removal of sand and gravel from their land. The lower court granted summary judgement for upland owners. The Supreme Court of Washington reversed and remanded, finding that the doctrine of damnum absque injurie applied only if the upland landowners' use was reasonable, and that the reasonableness of the use was a question of material fact which should be tried. Also a trial was needed to determine whether upland owners' actions were the actual and proximate cause of appellants alleged injury. Finally a trial was necessary to determine whether an apportionment of the damages among the several upland owners could be made, and to determine when the alleged damage occurred and when appellant became aware of it for purposes of applying the statute of limitations. (Segall-Florida) W76-03940

GRIFFITH V. NEW MEXICO PUBLIC SERVICE COMMISSION (PROVISION OF WATER BY SUBDIVISION DEVELOPER AND THE PUBLIC UTILITY ACT). 520 P2d 269-72 (NM 1974), 4 p.

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Descriptors: \*Water permits, \*Public utilities, \*New Mexico, \*Water distribution(Applied), \*Legal review, Judicial decisions, Water supply, Water conveyance, Water policy, Legal aspects, Administrative decisions, Administrative agencies, Adjudication procedure, Water supply development, Water users, Public rights.

Appellee developer had constructed a water system which provided water service to subdivision lot owners for a set monthly charge. One of the lot owners, whose water had been cut off, sought an order requiring the developer to obtain a certificate of public convenience and cecessity under the New Mexico Public Utility Act. The developer responded to this action by asserting that the water system was not a public utility and therefore did not come under the authority of the Act. After a hearing, the Public Service Commission issued the order, finding that the developer was operating a public utility. On appeal the direct court reversed, finding that no public utility existed since water was not furnished to or for the multiple of the public of the pub public' as required by the Act. The New Mexico Supreme Court, however, reinstated the order of the Public Service Commission, finding that, since the water system was essential to the subdivision and was available to all lot owners of the subdivi-sion, the Commission was justified in finding that the water was being offered to and for the public. (Hoffman-Florida) W76-03941

CITY OF STILLWATER V. OKLA WATER RESOURCES BOARD (PERFECTION OF FEDERAL GOVERNMENTS APPROPRIATION RIGHTS PASS TO UNIVERSITY). 524 P2d 938-947 (Okla Ct App 1974), 10 p.

\*Oklahoma, \*Water Descriptors: rights. Municipal water, "Appropriation, "Federal-state water rights conflicts, State governments, Surface waters, Universities, Water supply, Contracts, Dams, Damsites, Streams, Streamflow, Supply contracts, Cities, Water users. Identifiers: \*Administrative regulations, Water rights(Non-riparians).

Plaintiff city brought action for judicial review of a water Resources Board determination that the federal government had perfected its appropria-tion of water rights to a lake. Plaintiff contended that state statutory requirements for perfecting ap propriation of water rights had not been satisfied, and that subsequent federal transfer of those rights was thus impossible. Defendants, university and water resources board, contended the federal government had transferred all rights to the university, and that the city possessed only con-tractual rights granted by the university. Reversing the lower court's decision recognizing the city water rights in the lake, the Oklahoma Court of Appeals noted that the federal government had satisfied all requirements to appropriate the water rights to question. Furthermore, by filing a notice of interest, and by constructing a dam, the federal government complied with the intent of the Oklahoma statute to encourage quick completion of water projects. The court also noted that, since the city possesses neither vested water rights nor riparian rights, it has no claim to the water.

CRAWFORD V. STATE (LACK OF FLOURIDA-TION OF WATER NO BASIS FOR WITHHOLD-ING PERMIT FOR WATER WORKS INSTAL-

338 A2d 727-730 (Comm Ct Pa 1975), 4 p.

Descriptors: \*Pennsylvania, \*Flouridation, \*Distribution systems, \*Public health, \*Permits, Regulation, Judicial decisions, Legals aspects, Administrative agencies, Water treatment, Administration, Water distribution(Applied), Water storage, Water supply, Water purification, Water quality, Quality control.

Identifiers: Ministerial acts, Discretionary acts. \*Flouridation,

Plaintiffs, who were concerned about dental decay, brought this action in mandamus to compel defendant state agencies to change their reguladetendant state agencies to change their regula-tions concerning the issuance of waterworks per-mits. Plaintiffs were seeking a regulation which would deny permits unless the water works com-panies flouridated their water supplies. As support for their claim, the plaintiffs relied on a state statute that required the defendant agencies to protect the health of the people of the state. The trial court dismissed the plaintiffs' complaint, however, holding that mandamus is proper only where the dispotted act is ministerial, and not where the disputed act is ministerial, and not where the act is discretionary. The court found that the statute gave the administrators of the state agencies the discretion to determine if administrative regulations were harmful to public health, and that the plaintiffs had stated no cause of action on which to base relief. (Hoffman-Florida)

BUTLER V. BRUNO ('RULE OF REASONABLE USE' OF SURFACE WATER). 341 A 2d 735-42 (RI 1975), 8 p.

\*Deflection, \*Surface Descriptors: Descriptors: "Deflection, "Surface waters, \*Reasonable use, "Adjacent landowners, \*Runoff, Damages, Rain, Springs, Swamps, Marshes, Gravels, Sewage disposal, Sewage, Retaining walls, Drainage, Floods, Rhode Island, Hydraulic engineering, Natural flow, Civil law, Trespass, Negligence, Watercourses(Legal aspects), Water table. Identifiers: \*Legal responsbility, Depository, Servitude, Tort.

Plaintiff landowners sought damages for injury to their land, house and sewerage system resulting from adjoining landowner's deflection of surface water from his property onto their premises. The lower court applied the 'common-enemy doctrine' and found that the defendant was not liable for the damages sustained by plaintiffs because he had used reasonable care in developing his land when he put in a three foot gravel fill necessitated by the high-water table over his land. The Supreme Court of Rhode Island rejected the common-enemy doc-trine and adopted the rule of reasonable use, which allows a landowner to make reasonable use of his land, and which holds him liable for damage to lands of others only when his harmful inter-ference with the flow of surface waters is un-reasonable. The case was therefore amended for a determination of the reasonableness of the defendant's interference with the flow of the surface waters. (Segall-Florida) W76-03944

STATE GAME COMMISSION V. RENICK (COMMISSION PUBLIC PURPOSE SUFFI-CIENT GROUNDS TO FLOOD LAND TO CREATE EASEMENT).

342 A2d 824-27 (Pa Comm Ct 1975), 4 p.

Descriptors: \*Condemnation, \*Eminent domain, \*Legislation, \*Pennsylvania, \*Easements, Construction, Dams, Wildlife, Hunting, Trapping, Water rights, Right-of-way, Real property, Land, Administrative agencies, Judicial decisions, Legal Identifiers: Interests in land, title,

Appellant Game Commission sought by resolution to acquire the 'perpetual right, privilege and easement occasionally to overflow, flood and submerge' appelees' land in connection with construction of a dam. Appellees contention, sustained by

the lower court, was that the Commission did not have authority to condemn any interest in land of lesser dignity than a fee simple absolute estate. The Commonwealth Court of Pennsylvania in reversing held that the Commission's power to acquire title to lands included the power to acquire any interest in land and was not limited to fee simple absolute. However, the grant of power to the Commission was to acquire only that interest in real estate necessary to carry out its purpose. (Segall-Florida) W76-03945

SOUTHEASTERN COLORADO WATER CON-SERVANCY DISTRICT V. SHELTON FARMS (WATER DECREES BOUND TO CALL OF THE

529 P2d 1321-28 (Colo 1975), 8 p.

Descriptors: \*Colorado, \*Water rights, Rivers, \*Phreatophytes, \*Prior appropriation, Riparian rights, Riparian waters, Riparian lands, Bodies of water, Water law, Water, Legal aspects, State governments, Administrative agencies, Priorities, Water conservation, Water users, Water allocation(Policy), Appropriation.

Identifiers: \*Colorado Water Right Determination

and Administration Act.

Appellee land companies had cleared land areas bordering the Arkansas River of phreatophytes (water using plants), and on the basis of such clearing were awarded certain water rights free from the call of any senior decreed water rights on the river. Appellants, a water conservancy district and others, were objectors to appellee's water rights applications in the lower court. Appelants argued on appeal that the trial court's decree did violence to Colorado's 'first in time-first in right' water theory, and would make administration of the priority system under the Colorado Water Right Determination and Administration Act (the Act) impossible. Appellees contended that no injury to prior appropriators occurred by reason of their practice. They reasoned that, since the water in question was previously unavailable due to the existence of phreatophytes, granting it to them would harm no one and would conform with the policy of maximum utilization and beneficial conservation of water. The Supreme Court of Colorado found support for appellants' position in the Act, and noted that if the lower court decree were affirmed, the clearing of land would generate a better water right than the earliest ditch on a river. Thus the court held that all water decrees of any kind are subject to the priority system. (Schilling-Florida) W76-03946

SUNSET IRRIGATION DISTRICT V. AILPORT (APPROPRIATION OF ADDITIONAL CREEK WATER BY DAM ENLARGEMENT). 531 P2d 1349-52 (Mont 1975), 4 p.

Descriptors: \*Irrigation districts, \*Dams, \*Appropriation, \*Water storage, \*Impoundments, \*Montana, Surplus water, Drainage, Lakes, Streams, Storage capacity, Jurisdiction, Rain, Ditches, Channels, Irrigation, Reservoirs, Runoff, Flooding, Reservoirs, Runoff, Flooding, Beneficial use, Construction, Springs, Basins, Aquifers, Drainage districts.

Identifiers: Laches.

Plaintiff irrigation district brought suit to appropriate additional waters of a creek by enlarging an existing dam. Defendant prior appropriators re-sisted the appropriation and filed a cross-claim and counter-claim to require water users on an adjudicated stream to use water according to decree. The trial court granted the appropriation and de-nied relief on the counter-claim and cross-claim. Defendants asserted that the district's action to appropriate waters was by enlargement of an un-lawful dam. The Supreme Court of Montana found that the existing dam was not unlawful; that no injury was shown to prior appropriators; that there

### Field 6-WATER RESOURCES PLANNING

### Group 6E-Water Law and Institutions

was surplus water to be appropriated; that the storage would benefit other users; that the proposed dam would not interfere with others; and that defendants were guilty of laches. Thus the trial court was correct in granting an appropriation of water. (Segall-Florida)

ALEXANDER V. CENTRAL OREGON IRRIGA-TION DISTRICT (IMPOSITION OF CONSTRUCTIVE TRUST ON WATER DISTRICT). 528 P2d 582-94 (Oregon Ct App 1974), 13 p.

Descriptors: \*Irrigation districts, \*Water rights, \*Supplemental irrigation, \*Costs, \*Oregon reclamation, Public lands, Development, Arable land, Beneficial use, Streams, Priorities, Legislation, Deserts, Gravitational water, Adjudication procedure, Adjusted costs, Irrigation water, Water users.

Identifiers: \*Constructive trusts, Fiduciary relationships, Laches, Declaratory judgements, Liens, Inchoate water rights, Vested water rights, Res judicata.

Plaintiff landowners brought suit against the state irrigation district seeking to have the supplemental water rights acquired by the district in a 1958 judicial decree impressed with a constructive trust in favor of the landowners. The lower court im-pressed the constructive trust and ordered the district to transfer the water rights to the landowners for \$40, per acre. Since the district made no show-ing that plaintiffs had notice of the 1958 supplemental rights adjudication, the contention that the constructive trust should fail under the doctrine of res judicata had no merit. The district also contended that plaintiffs could not have been awarded the supplemental rights in 1958, and, therefore, no fiduciary relation could have existed. Other district arguments included: That plaintiffs should be barred by laches; that the price of \$40. per acre was unreasonable; that plaintiffs should be required to pay their share of the post - 1958 improvements to the irrigation system; and that interest should be pain on the price of the supplemental water rights. All of these contentions were rejected and the constructive trust upheld by the Oregon Court of Appeals. (Segall-Florida)

### NIENHUSER V. WHITSON (ADEQUACY OF SUBSTITUTE WATER DELIVERY SYSTEM). 528 P2d 933-34 (Colo Ct App 1974), 2 p.

Descriptors: \*Water delivery, \*Irrigation, \*Conveyance structures, \*Water rights, \*Colorado, Easements, Jurisdiction, Construction, Repairing, Maintenance, Ditches, Properties, Judicial decisions, Facilities, Lateral conveyance structures, Water demand, Water users, Irrigation

systems, Legal review.
Identifiers: Historical flow, Injunctions, Trash gates, Property rights.

Defendants owned land tranversed by lateral through which water from a ditch flowed onto and irrigated plaintiffs' land for many years. Pursuant to a court order, defendants constructed a sub-stitute water delivery system across their land to continue providing plaintiffs with their historical flow of water. Plaintiffs appealed from the denial of a motion to alter the trial court's order denying an injunction and releasing a performance bond an injunction and releasing a performance bond posted by defendant. The trial court found that the defendants had met their burden of proving that the substitute system was adequate and that they were complying with the original stipulation and order. These findings were conclusive upon review. In affirming, the appellate court also held that plaintiffs had not offered proof that they were not receiving their historical flow of water, and thus were not being deprived of their property rights without a hearing. (Segall-Florida)

TEXAS COUNTY IRRIGATION AND WATER RESOURCES ASS'N V DUNNETT (SALT WATER INJECTIONS INTO GLORIETTA SAND FORMATION NOT POLLUTANT OF FRESH WATER AQUIFIER), 527 P2d 578-84 (Okla 1974), 7 p.

Descriptors: \*Injection, Freshwater, \*Saline water, \*Injection wells, \*Aquifers, Pollution, \*Oklahoma, Reasonable use, Appropriation, Descriptors: Damages, Evaporation, Waste disposal, Sandstones, Permits, Facies (Sedimentary), Sandstones, Shales, Conduits, Irrigation, Industries, Jurisdiction, Brines, Judicial decisions, Saline water intrusion, Salts.

Identifiers: \*Gas wells, Due process of law, Surface owners. Surface pressure.

County Irrigation and Water Resources Association appealed an order of the Oklahoma Corporation Commission which permitted injection of salt water from gas wells into a fresh water sand formation pursuant of rules and regulations set forth by the Commission. Appellants argued that the Commission's finding that injections of salt water into the formation would not pollute the fresh water bearing aquifer overlying the formation was not supported by substantial evidence. Appellants also argued that the Commission had appropriated the formation from the surface owners without due process of law. In affirming the order, the Supreme Court of Oklahoma found that the order and findings of fact of the Commission were supported by substantial evidence, and that, since plaintiffs did not contend that they had sustained any damage as a result of the injections of salt water, under the rule of reasonable use the order was not contrary to law. (Segall-Florida) W76-03950

COMMUNITY COLLEGE V. FOX (CLEAN STREAMS LAW OR SEWAGE FACILITIES ACT). 342 a2d 468-83 (Pa Com Ct 1975), 16 p.

Descriptors: \*Pennsylvania, \*Constitutional law, \*Administrative agencies, \*Judicial decisions, Water, Water law, Legal aspects, Sewers, Environment, Water pollution, Regulation, Permits, Environmental effects, Ecology, Water pollution control, Construction.

Identifiers: Pennsylvania Clean Streams Law, Pennsylvania Sewage Facilities Act, Pennsylvania Constitution, Environmental impact.

Appellant county authority was granted a permit to construct a sewage pipeline by the Department of Environmental Resources (DER). Contending that DER should have analyzed the indirect and long-range environmental impact of the pipeline, appellee landowners appealed the DER decision to the Environmental Hearing Board (EHB), which agreed and vacated the permit. In doing so, EHB ruled that DER should have considered certain environmental factors in addition to those included in a previous court decision construing the state's duty as trustee under the Environmental Rights Amendment of the Pennsylvania Constitution. On appeal, the Commonwealth Court of Pennsylvania held that the previous appeal to EHB fell within the Clean Streams Law, but not within the Sewage Facilities Act as argued by appellees. The court further ruled that DER had issued the permit in full compliance with the Clean Streams Law, as well as with the additional standards set forth by the court in Payne v. Kassab. Although the court admitted that further development of the geographical area could be a remote consequence of the installation of the sewer line, such a loss of open space was not the type of harm which would justify DER in refusing a sewer construction permit. (Schilling-Florida) W76-03951

PAOLICELLI V. WOJCIECHOWSKI (ACTION BY LANDOWNERS FOR DAMAGES FROM CREATION OF POND ON ADJOINING LAND). 333 A2d p 532-536 (Superior Court, New Jersey,

Descriptors: \*New Jersey, \*Flood damage, \*Adjacent landowners, \*Drainage, Seepage, Water control, Water storage, Ditches, Ponds, Floods, Water law, Negligence, Soil stabilization, Seepage control, Planting management, Legal aspects, Judicial decisions, Trespass, Compensation, Water.

Identifiers: Injunctive relief, Intentional torts, Damages, Nuisance.

Plaintiff landowners sought relief against defendant, an adjoining landowner, contending that defendant's creation of a pond on his property resulted in an unreasonable flow of water on plaintiffs' land. Finding that plaintiffs had an adequate remedy of damages at law, the court denied plain-tiffs' request for an injunction directing removal of the pond. The court, noting that plaintiffs did not have the burden of showing the extent to which the wetness of their land resulted from the pond rather than natural conditions, awarded plaintiffs the cost of substantially remedying the adverse flooding effects and restoring their pro-perty to its prior condition. The court awarded ad-ditional compensation for probable future adverse effects of the flooding, and for the reduction in value of the portion of plaintiffs' property adjoing-ing the pond. However, court denied an award of punitive damages, since there was not evidence of paintire damages, since there was not evaluate of actual malice or wanton and willful disregard of the plaintiffs' rights. (Schilling-Florida) W76-03952

CITY OF BRUCE V. EDWARDS (ACTION TO RECOVER DAMAGES FOR LAND FLOODED BY CONSTRUCTION OF SEWER LAGOON BY

309 So 2d, p 515-516 (Mississippi, 1975), 2 p.

Descriptors: \*Mississippi, \*Sewage, \*Construction, \*Overflow, \*Sewage lagoons, Judicial decisions, Penalties(Legal), Sewage disposal, Floods, Flood damage, Legal aspects, Water law, Wastes, Domestic wastes, Municipal wastes, Sewers, Lagoons, Sewerage. Identifiers: \*Negligent construction. Nuisance(Legal aspects).

Plaintiff sought to recover damages as a con-sequence of the flooding of his lands from a recently constructed sewer lagoon of the defendant city on nearby property. The trial court awarded plaintiff damages. The Supreme Court af-firmed, finding the defendant had no easement, license, or consent from appellee to cause the water or sewage to flow onto or across his land. The Court found, however, that a certain portion of the damages awarded were not proven by sufficiently clear evidence, and therefore ordered a new trial on the issue of damages. In the alternative, plaintiff was given the option of entering a remittitur for the unproven portion of the damages before the judgement became final. (Hoffman-W76-03953

UNITED STATES V. MÁINE (COMPLAINT BY U.S. AGAINST 13 ATLANTIC STATES TO DETERMINE OWNERSHIP OF SEABED BEYOND THREE-MILE MARGINAL SEA).
95 S Ct 1155-1162 (1975), 8 p.

Descriptors: \*Judicial decisions, \*Atlantic Coastal Plain, \*Federal government, \*Submerged Lands Act, \*Ownership of beds, State governments, Boundary disputes, Legal aspects, Water law, Legislation, Boundaries(Property), Beds, Beds under water, Continental Shelf, Tidal waters, Aquatic soils, Land tenure. Identifiers: Territorial waters, Seabed mining, Atlantic states, Seabed ownership, Outer Continental Shelf Lands Act, Coastal waters.

Plaintiff, the federal government, filed a complaint against the thirteen Atlantic states to determine against the thirteen Atlantic states to determine ownership of the seabed in the area beyond the three-mile marginal sea. Plaintiff claimed sovereign rights over the area for the purpose of exploiting the natural resources and claimed that each defendant had interferred with those rights. Defendants, with the exception of Florida, claimed title to the seabed to the limits of U.S. territorial waters. The Special Master determined that prior case law mandated a finding in favor of the United States. The Supreme Court affirmed, finding that the protection and control of marginal sea is a function of national sovereignty. The Court rejected defendants' claim to ownership prior to adoption of the Constitution. Both the Submerged Lands Act of 1953 and the Outer Continental Shelf Lands Act of 1953 confirm the paramount rights of the United States to the offshore seabed. (Jenkins-Florida) W76-03954

UNITED STATES V. DIAMOND (ACTION TO ENJOIN IN CERTAIN SALT WATER TIDAL MARSHLANDS).
512 F 2d., p 157-160 (Fifth Circuit Court of Ap-

peals, 1975), 6 p.

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Descriptors: \*Georgia, Judicial decisions, \*High water mark, \*Permits, \*Rivers and Harbors Act, Navigable waters, Federal jurisdiction, \*Dredging, \*Tidal marshes, \*Regulation, Environ-mental effects, Environmental control, Real property, Legals aspects, Penalties(Legal), Construc-tion, Land tenure, Landfills, Land use, Struc-tures, Boundaries(Property), Harbors. Identifiers: Fill permits, Injunctive relief, Naviga-

tion obstruction, Standing(Legal).

Plaintiff, federal government, sued to enjoin defendant, landowner, from filling and construction operations on certain saltwater tidal marshlands owned by defendant. Defendant obtained a permit to build a walkway and dock. At that time permits for shoreward filling were not required if the dock marked the boundary of a designated harbor line. Defendant argued that the prior permit constituted a de facto designation of a harbor line; that the marsh is not a navigable body of water; that his property is above the mean high tide line and thus outside the jursidiction of the Corps of Engineers; and that a suit to enforce the Rivers and Harbors Act of 1899 can only be brought at the request of the Secretary of Army. The Fifth Circuit Court of Appeals affirmed the lower court injunction holding that the dock permit did not extend to filling in the marsh because no formal harbor lines were established at that time. Further, the body of water adjoining the land was held to be legally navigable. Defendants' claim that his property lay landward of the mean high water mark was a factual determination which would not be reviewed on appeal absent plain error. (Jenkins-Florida)

PRESERVATION AND DEVELOPMENT OF

COASTAL AREAS. Ala Code, Tit 8, S 312-320, (Cum Supp 1973).

Descriptors: "Alabama, "Administrative agencies, "Water resources development, Permits, Preservation, Resource allocation, Legislation, Riparian rights, Commercial fishing, Recreation, Industries, Mineral industry, Coasts, Shores, Decision making, Leadership, Planning, Water policy, Water zoning, Ecology, Estuaries, Harbors, Federal government, Dredging, Landfills. Identifiers: "Coastal waters, Coastal Zone Management Act of 1972, Public hearings, Coastal zone management State policy.

zone management, State policy.

Alabama declares herein that it is state policy to preserve, protect and develop the resources of the state's coastal area. It is, therefore, of prime concern to the state that the various counties and mu nicipalities have unified and standardized methods and policies for dealing with water use. The Alabama coastal area board, composed of eight members who shall be paid for expenses only, is to develop a program to include: (1) identification of coastal area boundaries; (2) identification of coastal resources; (3) evaluation of resources; (4) determination of conflicts in coastal resource use and development; (5) determination of permissible coastal area uses; (6) designation of areas of par-ticular concern in the coastal area; and (7) development of guidelines for permit issuance in compliance with general coastal program aims.

The board is empowered to initiate legal action against any person believed to be in violation of this statute. (Parrish-Florida)

STATE OF FLORIDA BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND V. CHARLEY TOPPINO AND SONS, INC. (ACTION FOR WRONGFUL EXCAVATION AGAINST OWNER OF SUBMERGED LANDS IN RAY OR ELECTION. BAY OF FLORIDA).
514 Federal Reporter 2 d, p 700-704, (Fifth Circuit Court of Appeals, 1975), 5 p.

Descriptors: \*Florida, \*Excavation, \*High water Descriptors: Fromas, Excavation, Figuration mark, \*Dreding, Trespass, Public rights, Water law, Judicial decisions, Harbors, Public lands, Management, Navigable waters, Abatement, Channels, Construction, Federal jurisdiction, Rivers and Harbors Act, Administrative agencies, Changeline (Penarth). Permits, Water rights, Boundaries(Property), Ownership of beds, Seashores, Bays. Identifiers: \*Injunctive relief, \*Bay of Florida.

Plaintiff Board of Trustees filed suit against con-Plaintiff Board of Trustees filed suit against con-tractor defendant alleging wrongful excavation of plaintiff's land lying beneath the navigable waters of the Bay of Florida. In 1965 defendant bought two parcels of submerged lands held in trust by plaintiff and began dredging activities to convert the area into a small harbor. Plaintiff claimed some of the dreding was on its land and sought an in-junction to require restoration. The United States District Court for the Southern District of Florida conceded that plaintiff stated a valid cause of action, but denied relief on grounds that plaintiff had failed to prove ownership of the lands in question. Determination of ownership depends on the loca-tion of a boundary line which is fixed by the mean high water line. Surveyors testified that the mean high water line in the Bay of Florida may vary by as much as 600 feet at some points. The court ruled that plaintiff had failed in its burden of proof because there was insufficient evidence showing whether defendant's actions, in fact, constituted a trespass. The Fifth Circuit Court of Appeals found no reversible errors and affirmed. (Parrish-Florida) W76-03957

UNITED STATES V. DETREX CHEMICAL IN-DUSTRIES, INC. (VIOLATION OF POLLUTION DISCHARGE PERMIT).

393 F Supp, p 735-739, (N D Ohio, E D, 1975), 5 p.

Descriptors: \*Penalties(Legal), \*Federal Water Pollution Control Act, \*Water pollution control, \*Federal government, Legals aspects, Water law, Permits, Regulation, Legislation, Judicial decisions, Water quality, Water quality control, Chemical wastes, Industrial wastes, Pollutants, Public health, Water pollution sources, Water pollution effects, Organizations, Wastes. Identifiers: Federal Water Pollution Control Act (FWPCA) Amendments of 1972, \*National Pollutant Discharge Elimination System.

The United States government brought an action against defendant chlorine-alkaline plant to collect

civil monetary penalties for exceeding the bounds of a National Pollutant Discharge Elimination System permit and for violation of an order by the Environmental Protection Agency (EPA). Defendant contended that it can be assessed only a maximum penalty of \$10,000 per day regardless of the number of violations, and that an EPA order, requiring defendant to comply with the terms of its permit before a specified date, precluded the assessment of civil penalties for violations which oc-curred before the date. The United States District Court for the Northern District of Ohio held that under the Federal Water Pollution Control Act, the maximum civil penalty for violation of a Na-tional Pollutant Discharge Elimination System permit is \$10,000 per day regardless of the number of violations occurring on that day. The court also held that the EPA order requiring defendant to comply with the terms of its permit before a specified date did not preclude assessment of civil permitted for violations which conversed before the penalties for violations which occurred before that date. (Nursey-Florida)

LEGAL ASPECTS OF WASTE POLLUTION

LAWS, Kansas Livestock Association, Topeka For primary bibliographic entry see Field 5G. W76-03975

RACEWAYS: EXOTIC SPECIES MOST AF-FECTED BY PROPOSED E.P.A. DISCHARGE

Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management. For primary bibliographic entry see Field 5G. W76-03980

IMPACTS OF IMPOSING SELECTED POLLU-TION CONTROLS

Michigan State Univ., East Lansing. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5G.

STATUS OF THE ILLINOIS LIVESTOCK WASTE MANAGEMENT REGULATIONS, Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control. For primary bibliographic entry see Field 5G. W76-03984

### 6F. Nonstructural Alternatives

ENVIRONMENTAL MANAGEMENT FOR THE METROPOLITAN AREA-WATER QUALITY, PART III.

Stevens, Thompson and Runyan, Inc., Seattle,

For primary bibliographic entry see Field 5G. W76-03501

MEASURING OUR WATER SUPPLY, For primary bibliographic entry see Field 6D. W76-03597

NEW CLASSIFICATIONS ADOPTED AND ASSIGNED TO CERTAIN WATERS IN THE YAD-KIN RIVER BASIN.

North Carolina Environmental Management Commission, Raleigh. For primary bibliographic entry see Field 5G.

ORDINANCE AMENDING THE COMPREHENSIVE ZONING ORDINANCE NO. 3011 (FOR FLOOD HAZARD PROTECTION, FORT WORTH, TEXAS). Fort Worth, Tex.

Ordinance 6567 (1971). 13 p.

### Field 6—WATER RESOURCES PLANNING

### Group 6F-Nonstructural Alternatives

Descriptors: \*Flood plains, \*Water zoning, \*Flood plain zoning, \*Land use, \*Texas, Flood control, Flood recurrence interval, Penalties(Legal), Administration, Maps, Legislation, Land develop-ment, Nonstructural alternatives, Water policy, Water law, Utilities, Public health.

Identifiers: \*Administrative procedures, Fort Worth(Tex).

This ordinance divides flood plain districts, based upon the probability of floods within those areas, into two categories: lands subject to floods every one hundred years, and lands subject to floods every fifty years. It then presents a detailed list of land uses permitted within each of the categories. The City of Fort Worth Public Works Department is responsible for delineating these different areas which must be shown on the official map of the city. A procedure is specified whereby exceptions to permitted uses on lands subject to floods every one hundred years may be allowed by the Zoning Board of Adjustment. Persons applying to the Board for such an exception must present detailed information on a number of topics specified in the ordinance. If this information shows that the objectives of the use restrictions will not be injured by the proposed use, the Board may grant the exception. Fines are authorized to aid the appropriate authorities in enforcing all the provisions of this ordinance. (Hoffman-Florida)

FLOOD HAZARDS ALONG THE BALCONES ESCARPMENT IN CENTRAL TEXAS--ALTER-NATIVE APPROACHES TO THEIR RECOGNI-TION, MAPPING, AND MANAGEMENT,
Texas Univ. at Austin. Dept. of Geological

Sciences. For primary bibliographic entry see Field 4A.

THE RIVER THAMES FLOOD DEFENCE BAR-

RIER, Great London Council, (England), Dept. of Public Health Engineering.

For primary bibliographic entry see Field 4A. W76-03800

AMENDMENTS TO ZONING ORDINACE FOR FLOOD CONTROL.

Charleston County, S C Ordinances 178, 183, 184, (1974), 4 p.

Descriptors: \*South Carolina, \*Water zoning, Building codes, "Electrical wiring, "Legislation, Plumbing, Flood protection, Valves, Safety factors, Insurance, Protection, Regulation, Standards, Sewers, Zoning, Permits, Structures, Buildings. Identifiers: \*Flood hazard areas.

Ordinance 178 amends the zoning ordinance for Charleston, South Carolina, by requiring that the first floor elevation of new or moved structures must meet the minimum height requirements of flood boundaries set by the Federal Flood In-surance Program. The ordinance also makes technical amendments concerning flood hazard zones in the section relating to zoning permit requirements. The Charleston zoning ordi had adopted by reference the National Electric Code as the electric code for Charleston County, Ordinance 183 amends that portion of the zoning ordinance by adding regulations concerning electric wiring, circuits, and panels in flood hazard areas. The Charleston zoning ordinance had also adopted by reference the Southern Standard Plumbing Code as the plumbing code for Charleston County, Ordinance 184 amends that portion of the zoning ordinance by requiring the installa-tion of a backwater valve in the house sewer or drain line. (Hoffman-Florida) W76-03933

FLOOD HAZARD AREAS.

Vermont State Agency of Environmental Conservation, Monpelier. Vermont, Gen Act No 263 (1974), 5 p.

Descriptors: \*Vermont, \*Flood control, \*Water zoning, \*Water management(Applied), \*Multipurpose projects, Administration, Management, Regulation, Water policy, Legislation, Standards, Comprehensive planning, Water law, Legal aspects, Jurisdiction, Flood damage, Floods, Hazards.

Identifiers: \*Flood management, \*Flood hazard

The General Assembly of the State of Vermont has found it necessary to initiate a management program flood-prone lands. To serve as the basis for this program, the Secretary of the Agency of Environmental Conservation shall notify each municipality of the location of flood hazard areas within its jurisdiction. After being so advised the municipality is required to hold a public hearing and to follow other prescribed administrative procedures for informing the public as to the contents of the flood hazard designation. Within a stipulated time after the public hearing, the mu-nicipality, after consultation with the regional planning commission, shall make any necessary alterations to the flood hazard area. After the flood hazard area designation becomes final, the municipality will adopt flood hazard bylaws aimed at regulating the area. The Secretary of the Agency will send to the municipalities sample bylaws to help them in formulating their own particular bylaws. These bylaws will set up standards and criteria for uses within the flood hazard areas. Before these bylaws may be adopted, the public is to be provided with certain specified opportunities to comment upon them. (Hoffman-Florida) W76-03934

GUIDELINES FOR DELINEATION OF FLOOD-WAYS AND FLOOD HAZARD AREAS.

Indiana State Dept. of Natural Resources, Indianapolis.

Indiana Natural Resources Comm Policy State-ment, March 28, 1974, 8 p.

Descriptors: \*Indiana, \*Regulation, governments, \*Floodways, \*Flood plains, Floods, Flood protection, Flood peak, Flood control, Flood flow, Flood data, Flood profiles, Administrative agencies, Bodies of water, Water, Water law, Legal aspects, Floodwater, Hazards. Identifiers: \*Flood hazard areas.

Indiana has adopted guidelines for the delineation of Natural Resource Commission floodways and flood hazard areas, and shall apply them to the delineation of all such areas in the State of Indiana. Guidelines are set forth whereby the flood protection afforded by existing dams, dikes, levees, and other channel modifications will be recognized in determining the adequancy of flood protection. Also set forth are procedures for the determination of provisional peak regulatory flood discharge and final peak regulatory flood discharge. The regulatory flood profile shall be determined by successive solutions of the dynamic equation of gradually varied flood based on the Bernoulli Energy Equation, using electronic computer programs and the procedures set forth in this policy. Provisions are included covering the methods to be used in the delineation of flood-ways, flood hazard areas, floodway districts, and floodway fringe districts. All such delineations are subject to approval by the Natural Resources Commission, With respect to bodies of water which constitute interstate borders, determina-tions and delineations made pursuant to this policy will be accomplished in coordination with the state or states. (Schilling-Florida) party state W76-03935

MODEL ZONING ORDINANCE FOR FLOOD HAZARD AREAS

Indiana Dept. of Natural Resources, Indianapolis. Indiana Department of Natural Resources, Model Ordinance (1974), 8 p.

Descriptors: \*Permits, \*Indiana, \*Local governments, \*Classification, \*Flood plain zoning, Governments, Administrative agencies, Legislation, Water law, Legal aspects, Floods, Flood protection, Flood control, Flood flow, Flood plains, Flood profiles, Flood proofing, Flood waters, Floodways, Water utilization.

This model ordinance recommends that flood plain areas be divided into two sections: Floodway (FW) districts and Floodway Fringe (FF) districts The floodway is defined as the area which carries the principal flow of floodwaters. The floodway fringe, which is subject to fewer restrictions, is that area likely to be covered by quiescent flood-waters. In FW districts, it is recommended that only agricultural, recreationa, park and forestry uses, and wildlife and nature areas be permitted by right. The following uses would be special exceptions in such areas, and allowed only after a permit has been obtained: water management facilities; transportation facilities; water-related urban facilities; temporary or seasonal uses; and other floodtolerant or open space urban uses. With respect to FF districts, any use deemed appropriate would be allowed, the sole restriction being that all buildings constructed have a flood protection grade at least two feet above the regulatory flood profile. If the flood plain is not divided into FW and FF districts, the provisions set forth for FW districts would apply to the entire flood plain. (Schilling-Florida) W76-03936

### 6G. Ecologic Impact Of Water Development

ENVIRONMENTAL MANAGEMENT FOR THE METROPOLITAN AREA-WATER QUALITY,

Stevens, Thompson and Runyan, Inc., Seattle, Wash.

For primary bibliographic entry see Field 5G. W76-03501

A NEW APPROACH TO INTERNATIONAL EN-VIRONMENTAL COOPERATION; THE NATO COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY,

Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G. W76-03594

FEDERAL ENVIRONMENTAL LAWS AND

REGULATIONS,
Fluor Engineers and Constructors, Inc., Anaheim,

For primary bibliographic entry see Field 5G. W76-03806

RESEARCH NEEDS RELEVANT TO ENVIRON-MENTAL DATA, (PAPER OF THE TECHNICAL COUNCIL ON WATER RESOURCES PLANNING AND MANAGEMENT). Environmental Research and Technology, Inc., Concord, Mass. Environmental Studies Div.

B. H. Willis

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D C m w re St M

Journal of the Hydraulics Division, Proceedings of ASCE, Vol 101, No HY11, p 1423-1432, November, 1975. 4 fig, 1 ref, 1 app.

Descriptors: \*Environmental control, \*Data collections, \*Research priorities, Environmental effects.

Identifiers: \*Environmental data, \*Research needs, Data requirements, Environmental impact statement.

Problems associated with the adequacy of environmental data, primarily as currently incorporated in environmental impact assessment re-ports, are analyzed. The context in which environmental data are used must be considered. Data can be used for academic and scientific research pur-poses, environmental impact assessment pur-poses, or resource planning purposes. In all three cases the data requirements are different. Often, however, the distinctions are not made. Two basic data acquisition requirements are necessary: the establishment of an initial preproject data base; and the monitoring of actual impacts during the operation of the project. Data requirements neces-sary to establish intermedia relationships must be established. The development and application of new techniques for collecting environmental data are also necessary. Remote sensing techniques can be applied, especially after the recent develop-ments in military reconnaissance and the space program. Regional data monitoring networks should also be implemented. Major elements of such systems are now in operation. Perhaps the most critical research need is to coordinate current data collection efforts to make data readily accessable to users. Data collection activities should be coordinated. There should be an efficient means for updating environmental data. Data appropriate to indicate cumulative environmental impacts of projects on a regional scale should be identified. This brings up the question of level of detail for the analysis of site-specific impacts. It is concluded that, due to a lack of a coordinated environmental data base, environmental impact statement efforts are inefficient. (Pinto-FIRL)

COWANESQUE LAKE, COWANESQUE RIVER, TIOGA COUNTY, PENNSYLVANIA, (FINAL ENVIRONMENTAL IMPACT STATEMENT). Corps of Engineers, Baltimore, Md. For primary bibliographic entry see Field 8A.

NAVAL SUBMARINE BASE, NEW LONDON, GROTON, CONNECTICUT DREDGE RIVER CHANNEL, VOLUME 1, (ENVIRONMENTAL IMPACT STATEMENT). Department of the Navy, Washington, D.C. For primary bibliographic entry see Field 8A. W76-03924

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earch pact GEOTHERMAL LEASING PROGRAM, VOLS. II AND III-LEASING OF GEOTHERMAL RESOURCES IN THREE CALIFORNIA AREAS (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Department of the Interior, Washington, D.C. For primary bibliographic entry see Field 4B. W76-03925

CORKSREW SANCTUARY: USE OF THE MAR-KET FOR PRESERVATION,

Environmental Protection Agency, Boston, Mass. For primary bibliographic entry see Field 6G. W76-03928

CORKSREW SANCTUARY: USE OF THE MAR-KET FOR PRESERVATION,

Environmental Protection Agency, Boston, Mass. B. J. Ingle.

Environmental Affairs, Vol 3, No 4, p 647-686 (1974). 40 p. 53 ref.

Descriptors: \*Wildlife habitats, \*Preservation, \*Swamps, \*Florida, Drainage, Drainage area, Canals, Dikes, Local governments, Marsh management, Runoff, Droughts, Surface-ground-water relationships, Wildlife management, Water requirements, Water level fluctuations, Marshes, State governments, Costs, Ecosystems, Cranes, Market value, Public benefits.

Identifiers: \*National Audubon Society, 7B. Data Acquisition
\*Corkscrew Swamp Sanctuary, Refuges, Water Identifiers: table, Cypress, Storks.

The National Audubon Society, owner and manager of Corkscrew Swamp Sanctuary in Collier County, Florida, is currently involved in a conflict with a real estate developer to preserve the swamp from suffering the effects of drainage on the developer's adjacent lands. By marshalling the funds and votes of local, environmentally con-cerned residents, the Society has been able to force the developer to modify his operations, as well as to buy a significant amount of 'buffer' acreage. Still, the drainage goes on, lowering the water table of the whole area and threatening the swamp's continued viability as a wildlife refuge and cypress stand. The Society's greatest problem is proving, in dollar terms, the worth of the swamp, and therefore the degree of damages caused by drainage. Since any area that is open for the use and enjoyment of the public benefits both paying and non-paying supporters, the amount that the Society has been able to solicit for swamp preservation is not an adequate description of its value. Furthermore, mere preservation is not enough, in many cases, since success depends on the integration of the subecosystem of the natural area into a larger inclusive system under regional control. (Parrish-Florida) W76-03928

EASTLAKE COMMUNITY COUNCIL V. ROANOKE ASSOCIATES, INC. (ENVIRONMENTAL CHALLENGE TO CONSTRUCTION ON LAKESHORE). For primary bibliographic entry see Field 6E. W76-03937

### 7. RESOURCES DATA

### 7A. Network Design

RESEARCH NEEDS RELEVANT TO ENVIRON-MENTAL DATA, (PAPER OF THE TECHNICAL COUNCIL ON WATER RESOURCES PLANNING AND MANAGEMENT), Environmental Research and Technology, Inc., Concord, Mass. Environmental Studies Div. For primary bibliographic entry see Field 6G.

W76-03823

STREAM CHANNEL MEASUREMENTS IN NEW ZEALAND, Victoria Univ., Wellington (New Zealand). Dept.

of Geography.

Journal of Hydrology (New Zealand), Vol 13, No 2, p 135-138, 1974. 1 fig, 1 tab, 10 ref.

\*Streams, Descriptors: \*Geomorphology, \*Drainage density, Erosion, Channel morphology, Channels, Measurement.

Identifiers: \*Fluvial process, \*New Zealand, Definitions, Stream length, Mesh length.

The confusion arising from using morphometric data published by various agencies without following any consistent definition was described. As an example, it was pointed out that stream lengths as defined by the New Zealand Ministry of Works constitute the length of the stream up to the boundary divide line, also called 'mesh lengths.' However, in standard and normal definition, the stream length for each order of stream is defined as the length of the active channel. Some examples of misinterpretation were cited. Finally it was concluded that the morphometric data published by the New Zealand Ministry of Works are mislead ing because of the error of confusing mesh length with stream channel length. (Bhowmik-ISWS) W76-03856

APPLICATION OF PULSE POLAROGRAPHY TO POLLUTANT ANALYSIS, Princeton Applied Research Corp., Princeton, N.J. For primary bibliographic entry see Field 5A.

THE SQUARE-WAVE POLAROGRAPH AND ITS APPLICATION TO THE DETERMINATION OF HEAVY METALS IN THE ENVIRONMENT, Iowa Univ., Iowa City. Dept. of Chemistry. For primary bibliographic entry see Field 5A. W76-03530

GULF GENERAL ATOMIC PHENOL MONI-Gulf General Atomic, Inc., San Diego, Calif. For primary bibliographic entry see Field 5A. W76-03531

AUTOMATIC SEWER SAMPLING SYSTEM MONITORS FOR SPILLS, Union Carbide Corp., Chicago, Ill. For primary bibliographic entry see Field 5A. W76-03696

WATER COMPOSITIONS, Environmental Protection Agency, Region VII, Kansas City, Missouri. For primary bibliographic entry see Field 5A. W76-03698

OXYGEN DEMAND PARAMETERS: COR-RELATION OF BODS WITH COD, Sangamon State Univ., Springfield, Ill. For primary bibliographic entry see Field 5A. W76-03701

USE OF SATELLITE DATA IN URBAN HYDROLOGIC MODELS, Maryland Univ., College Park. Dept. of Civil Engineering.
R. M. Ragan, and T. J. Jackson.
Journal of the Hydraulics Division, American
Society of Civil Engineers, Vol 101, No HY12,
Proceedings Paper 11790, p 1469-1475, December
1975. 2 fig. 2 tab, 5 ref, 1 append. NASA NSG

Descriptors: \*Aerial photography, \*Remote sensing, \*Land use, \*Maryland, \*Watersheds(Basins), Hydrology, Urbanization, Hydraulics, Satellites(Artificial), Computers, Model studies. Identifiers: \*LANDSAT, \*Multispectral scanner subsystem, \*Anacostia River Basin(Md).

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The study investigated the use of computer aided analysis of LANDSAT multispectral data in estimating percentage of imperviousness and associated land uses needed in urban hydrologic modeling. An interactive computer was used to delineate seven land use classifications in the 132delineate seven land use classifications in the 132-aq mi Maryland portion of the Anacostia River Basin from LANDSAT data. The land-use dis-tributions compared favorably with those of an earlier study which obtained the same information through analysis of aerial photographs having a scale of 1:4800. The LANDSAT data was used to estimate the basin imperviousness as 25.1%, while the aerial photographic study had given 23.5%. Comparisons between the photographic and LANDSAT imperviousness estimates were made for subareas within the Anacostia Basin as small as 0.14 sq. mi. Approximately 94 man-days were as 0.14 sq mi. Approximately 94 man-days were required to complete the land-use analysis using the aerial photographs while less than 4 man-days were required to accomplish similar tasks using the LANDSAT data. (Lardner-ISWS) W76-03748

### Field 7—RESOURCES DATA

### Group 7B—Data Acquisition

RESPONSE TESTING OF PIEZOMETERS IN FRACTURED POROUS MEDIA,

Alberta Univ., Edmonton. Dept. of Geology For primary bibliographic entry see Field 2F. W76-03751

NEW TOOL ACCELERATES DIRECTIONAL SURVEYING.

World Oil, Vol 181, No 5, p 91-95, October 1975, 3

Descriptors: \*Boreholes, Telemetry, \*Data transmission, Drilling fluid, Pressure measuring instru-

Identifiers: Borehold azimuth, Borehold inclination.

A borehole telemetry system currently being field tested reduces the time required to obtain directional surveys or orient directional tools. The downhole equipment consists of a sensor and transmitter mounted in a nonmagnetic drill collar and protected from vibration by isolators in the top and bottom of the collar. The system transmits data through the drilling fluid in the form of pressure pulses whenever rotation is halted. The data are received by the surface equipment which consists of a printout console that contains a printer to provide a permanent record for each reading, and a display console which provides a lighted display of the data. Downhole equipment remains in the drill string and is always ready for use. Advantages that may result from the new system include reduced survey time, reduced tool orienting time, less risk of sticking bottomhole assemblies during surveys and existing drilling equipment requires no modification. (Ukayli-NWWA) W76-03758

A COMPARATIVE EVALUATION OF THE WEISS SATUROMETER, Battelle Pacific Northwest Labs., Richland, Wash

Ecosystems Dept.
For primary bibliographic entry see Field 5A. W76-03774

SOLAR HEATING TO PREVENT FREEZING IN RECORDING RAINGAUGES, Lincoln Coll. (New Zealand). Tussock Grasslands

and Mountain Lands Inst. For primary bibliographic entry see Field 2B. W76-03857

SUSPENDED SOLIDS IN WATER. Office of Naval Research, Arlington, Va. Ocean Science and Technology Div.
For primary bibliographic entry see Field 2L.

PRINCIPLES OF STUDYING SUSPENDED MATERIALS IN WATER,
Delaware Univ., Lewes. Coll. of Marine Studies.
For primary bibliographic entry see Field 2L.

W76-03877

BEAM TRANSMISSOMETERS FOR OCEANO-GRAPHIC MEASUREMENTS, Scripps Institution of Oceanography, San Diego,

Calif. Visibility Lab. For primary bibliographic entry see Field 2L. W76-03879

VOLUME-SCATTERING **FUNCTIONS** OCEAN WATERS,

Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab. For primary bibliographic entry see Field 2L. W76-03880

ABSOLUTE CALIBRATION OF A SCAT-TERANCE METER, Texas A and M Univ., College Station. Dept. of

Physics. For primary bibliographic entry see Field 2L. W76-03883

THE SUSPENDED MATERIAL OF THE AMAZON SHELF AND TROPICAL ATLANTIC OCEAN,

Delaware Univ., Lewes. Coll. of Marine Studies. For primary bibliographic entry see Field 2L. W76-03889

APPLICATIONS OF ERTS IMAGERY TO SNOW AND GLACIER HYDROLOGY, Geological Survey, Tacoma, Wash. For primary bibliographic entry see Field 2C.

METHODS FOR COLLECTION AND ANALY-SIS OF AQUATIC BIOLOGICAL AND MICROBIOLOGICAL SAMPLES, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 5A. W76-03915

### 7C. Evaluation, Processing and Publication

MEASURING OUR WATER SUPPLY, For primary bibliographic entry see Field 6D. W76-03597

TIDAL DATUMS AND MAPPING TIDAL BOUN-

National Ocean Survey, Rockville, Md. For primary bibliographic entry see Field 6E. W76-03625

FIELD STUDY OF EVAPORATALOGUE OF DATA FOR PHASE EVAPORATION--Bureau of Meteorology, Melbourne (Australia). Dept. of Science. For primary bibliographic entry see Field 2D. W76-03724

INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES. National Oceanic and Atmospheric Administra-tion, Rockville, Md.

For primary bibliographic entry see Field 2H. W76-03725

INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES. National Oceanic and Atmospheric Administra-

tion, Rockville, Md. For primary bibliographic entry see Field 2H. W76-03726

CONTROLLING WELL KICKS WHEN SHUT-IN METHODS ARE UNSAFE,

Shell Oil Co., Houston, Tex. For primary bibliographic entry see Field 8C. W76-03760

PROCESS CONTROL AS AN AID TO POLLU-TION CONTROL. For primary bibliographic entry see Field 5G. W76-03795

MULTI-PROCESS BIOLOGICAL TREATMENT

CH2M Hill, Bellevue, Wash.
For primary bibliographic entry see Field 5D. W76-03799

RESEARCH NEEDS RELEVANT TO ENVIRON-MENTAL DATA, (PAPER OF THE TECHNICAL COUNCIL ON WATER PLANNING AND MANAGEMENT) RESOURCES Environmental Research and Technology, Inc., Concord. Mass. Environmental Studies Div. For primary bibliographic entry see Field 6G. W76-03823

APPENDIX 2, SURFACE WATER HYDROLOGY, GREAT LAKES BASIN FRAMEWORK

Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 2E. W76-03862

APPENDIX 3, GEOLOGY AND GROUND WATER, GREAT LAKES BASIN FRAMEWORK STUDY.

Great Lakes Basin Commission, Ann Arbor, Michigan , Public Information Office. For primary bibliographic entry see Field 2F. W76-03863

APPENDIX 7, WATER QUALITY, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 5A. W76-03864

APPENDIX 11, LEVELS AND FLOWS, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 4A. W76-03865

APPENDIX 12, SHORE USE AND EROSION, GREAT LAKES BASIN FRAMEWORK STUDY. Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 2J. W76-03866

APPENDIX 14, FLOOD PLAINS, GREAT LAKES BASIN FRAMEWORK STUDY.
Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office For primary bibliographic entry see Field 4A. W76-03867

APPENDIX 15, IRRIGATION, GREAT LAKES BASIN FRAMEWORK STUDY.
Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office For primary bibliographic entry see Field 3F. W76-03868

APPENDIX 16, DRAINAGE, GREAT LAKES BASIN FRAMEWORK STUDY.
Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office.
For primary bibliographic entry see Field 4A.
W76-03869

APPENDIX 18, EROSIÓN AND SEDIMENTA-TION, GREAT LAKES BASIN FRAMEWORK STUDY.

Great Lakes Basin Commission, Ann Arbor, Michigan, Public Information Office. For primary bibliographic entry see Field 2J. W76-03870

SUSPENDED SOLIDS IN WATER. Office of Naval Research, Arlington, Va. Ocean Science and Technology Div. For primary bibliographic entry see Field 2L.

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MIE-THEORY MODELS OF LIGHT SCATTER-ING BY OCEAN PARTICULATES, Miami Univ., Coral Gables, Fla. Dept. of Physics. For primary bibliographic entry see Field 2L. W76-03881

SPATIAL DISTRIBUTION OF THE INDEX OF REFRACTION OF SUSPENDED MATTER IN THE OCEAN,
Oregon State Univ., Corvallis. School of Oceanog-

raphy. For primary bibliographic entry see Field 2L. W76-03882

EFFECTS OF TROPICAL STORM AGNES ON THE SUSPENDED SOLIDS OF THE NORTHERN CHESAPEAKE BAY, Johns Hopkins Univ., Baltimore, Md. Chesapeake For primary bibliographic entry see Field 2L.

CONTINUOUS LIGHT-SCATTERING PROFILES AND SUSPENDED MATTER OVER NITINAT DEEP-SEA FAN, Washington Univ., Seattle. Dept. of Oceanography. For primary bibliographic entry see Field 2L. W76-03886

PHYSICAL, CHEMICAL, AND OPTICAL MEA-SURES OF SUSPENDED-PARTICLE CONCEN-TRATIONS: THEIR INTERCOMPARISONS AND APPLICATION TO THE WEST AFRICAN SHELF,

University of South Florida, St. Petersburg. Dept. of Marine Science. For primary bibliographic entry see Field 2L. W76-03887

THE DISTRIBUTION OF PARTICULATE MATTER IN A NORTHWEST AFRICAN COASTAL UPWELLING AREA, Copenhagen Univ., Denmark. Inst. of Physical Oceanography.
For primary bibliographic entry see Field 2L.
W76-03888

TURBIDITY DISTRIBUTION IN THE DEEP WATERS OF THE WESTERN ATLANTIC TROUGH, Observatory, Geological

For primary bibliographic entry see Field 2L. W76-03890

VARIATIONS IN BENTHIC BOUNDARY
LAYER PHENOMEN'A: NEPHELOID LAYER IN
THE NORTH AMERICAN BASIN,
THE NORTH Geological Observatory,

Palisades, N.Y. For primary bibliographic entry see Field 2L. W76-03891

DISTRIBUTION OF SUSPENDED PARTICLES IN THE EQUATORIAL PACIFIC OCEAN, Oregon State Univ., Corvallis. School of Oceanography.
For primary bibliographic entry see Field 2L.
W76-03892

SUSPENDED MATTER AND THE STABILITY OF THE WATER COLUMN: CENTRAL CARIB-

BEAN SEA, Texas A and M Univ., College Station. Dept. of Oceanography. For primary bibliographic entry see Field 2L. W76-03893

LIGHT-SCATTERING MEASUREMENTS AND CHEMICAL ANALYSIS OF SUSPENDED MATTER IN THE NEAR-BOTTOM NEPHELOID LAVER OF THE GULF OF MEXICO, Texas A and M Univ., College Station. Dept. of ARIZONA. Oceanography. For primary bibliographic entry see Field 2L.

W76-03894

LIGHT SCATTERING AND SUSPENDED PARTICULATE MATTER ON A TRANSECT OF THE ATLANTIC OCEAN AT 11 DEG N, University of South Florida, St. Petersburg. Dept. of Marine Science. For primary bibliographic entry see Field 2L. W76-03895

SUMMARIES OF STREAM-STATISTICAL FLOW RECORDS, OKLAHOMA, THROUGH 1974.

Geological Survey, Oklahoma City, Okla. L. D. Mize. Open-file report, October 1975, 399 p. 6 fig. 3 tab.

Descriptors: \*Streamflow, \*Basic data collections, \*Flow measurement, \*Gaging stations, \*Oklahoma, Average flow, Low flow, High flow, Flow characteristics, Natural flow, Regulated

Tables summarizing daily streamflow data by year are presented for gaging stations in Oklahoma that have at least 5 years to either unregulated or regulated stream-gaging record through September 30, 1974. Separate tables are presented for unregulated and regulated periods of record. These summary tables include: (1) the number of days in each war tables mediude: (1) the number of days in each year that the daily discharge was between selected limits (duration tables), (2) the lowest mean daily discharge (frequency tables), (3) the highest mean daily discharge (frequency tables), (4) a monthly duration table for each station with 29 years or years of securicily, unsembled, record and (5) more of essentially unregulated record, and (5) statistics of annual discharge. These summaries provide useful information about the quantity, distribution, and variability of streamflow and provide basic data for developing relations for esti-mating streamflow at sites other than regular stream-gaging sites. (Woodard-USGS)

WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1975.

Geological Survey, Baton Rouge, La. Water-Data Report LA-75-1, 1975. 816 p, 5 fig, 3

Descriptors: \*Hydrologic data, \*Surface water, \*Groundwater, \*Water quality, \*Louisiana, Basic data collections, Streamflow, Gaging stations, Flow rates, Lakes, Reservoirs, Well data, Water levels, Chemical analysis, Physical properties, Sediments, Water temperature, Water analysis.

Water resources data for the 1975 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water water quanty or takes and reservours; and water levels and water quality for wells. This report contains discharge records for 76 gaging stations; stage only records for 36 gaging stations; water quality for 79 continuous, daily or bi-weekly stations, 20 partial-record stations, and 6 wells; and water levels for 105 observation wells. Also instantial to the following the state of cluded are data for 84 crest-stage partial-record stations and 114 flood-profile partial-record sta-tions. Additional water data were collected at 433 tions. Additional water data were collected at 433 various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States are also included. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (Woodard-USGS)

HYDROLOGIC UNIT MAP-1974, STATE OF

Geological Survey, Reston, Va. For sale by USGS, Reston, Va, 22092, Price \$1.25. Hydrologic Unit Map, 1975. 1 sheet, 1 map.

Descriptors: \*Maps, Hydrology, \*Arizona, Water resources, Data collections, Planning, Hydrologic systems, Regions, Land resources. Identifiers: \*Hydrologic unit maps(Ariz), \*Hydrologic boundaries, Subregions, Accounting

This map and accompanying table show Hydrolog-This map and accompanying table show reyulouse, ic Units in Arizona that are basically hydrographic in nature. The Cataloging Units shown will supplant the Cataloging Units previously used by the U.S. Geological Survey in its Catalog of Information on Water Data (1966-72). The Regions, Subretical Catalogical Survey in its Catalog of Information on Water Data (1966-72). The Regions, Subretical Catalogical Survey in its Catalogical gions and Accounting Units are aggregates of the Cataloging Units. The Regions and Subregions are currently (1974) used by the U.S. Water Resources Council for comprehensive planning, including the National Assessment, and as a standard geographical framework for more detailed water and related land-resources planning. The Accounting Units are those currently (1974) in use by the U.S. Geological Survey for managing the National Water Data Network. (Woodard-USGS)

HYDROLOGIC UNIT MAP-1974, STATE OF CALIFORNIA.

Geological Survey, Reston, Va.
For sale by USGS, Reston, Va, 22092, Price \$3.00
per set. Hydrologic Unit Map, 1975. 2 sheet, 2

Descriptors: "Maps, Hydrology, "California, Water resources, Data collections, Planning, Hydrologic systems, Regions, Land resources. Identifiers: "Hydrologic unit maps(Calif), "Hydrologic boundaries, Subregions, Accounting units, Cataloging units.

Two maps and accompanying tables show Hydrologic Units in California that are basically hydrographic in nature. The Cataloging Units shown will supplant the Cataloging Units previously used by the U.S. Geological Survey in its Catalog of Information on Water Data (1966-72). The Regions, Subregions, and Accounting Units are aggregates of the Cataloging Units. The Regions and Subregions are currently (1974) used by the U.S. Water Resources Council for comprehensive planning, including the National Assessment, and as a standard geographical framework for more detailed water and related land-resources planning. The Accounting Units are those currently (1974) in use by the U.S. Geological Survey for managing the National Water Data Network.
(Woodard-USGS) W76-03910

THE WATER TABLE ON LONG ISLAND, NEW YORK, IN MARCH 1974, Geological Survey, Mineola, N.Y.

For primary bibliographic entry see Field 4B. W76-03911

HARFORD COUNTY GROUND-WATER IN-FORMATION: WELL RECORDS, CHEMICAL QUALITY DATA, AND PUMPAGE, Geological Survey, Parkville, Md. L. J. Nutter, and M. J. Smigaj.

Maryland Geological Survey, Baltimore, Water Resources Basic Data Report No 7, 1975. 89 p, 1 plate, 3 tab, 6 ref.

Descriptors: \*Basic data collections, \*Water wells, \*Well data, \*Water quality, \*Maryland, Hydrologic data, Groundwater, Chemical analy-

#### Field 7—RESOURCES DATA

### Group 7C—Evaluation, Processing and Publication

sis, Aquifers, Water levels, Water yield, Specific capacity, Water utilization.
Identifiers: \*Harford County(Md).

Well data are presented for about 1,260 wells and chemical analyses for about 135 groundwater samples from Harford County in northwestern Mary-land. In addition, pumpage data of major ground-water users are included. About three quarters of the well records and chemical analyses are from wells penetrating metamorphic-rock aquifers; the remaining well records and chemical analyses are from wells penetrating sand and gravel aquifers.
(Woodard-USGS)

DRAINAGE AREAS FOR ILLINOIS STREAMS, Geological Survey, Champaign, Ill. K. M. Ogata.

Available from the National Technical Informa-tion Service, Springfield, Va 22161, as PB-246 298, \$5.50 in paper copy, \$2.25 in microfiche. Water-Resources Investigation 13-75, 1975. 120 p, 2 fig.

Descriptors: \*Drainage area, \*Streams, \*Illinois, \*Basic data collections, River basins, Watersheds(Basins), Sites. Identifiers: \*Drainage areas over 100 sq mi(III), Counties, Quadrangles.

Drainage areas are tabulated for all streams in Il-linois that drain over 100 sq mi. Also listed are drainage areas for numerous intermediate sites where streamflow data have been collected and where streaminow data have been contected and for other selected points. The report provides uniform, accurately determined drainage area figures for use in hydrologic investigations—such as low-flow frequency, flood frequency, and rainfall-runoff studies. Usually, drainage area is one of the more important parameters required for planning and design of water-related projects. Two maps of the State of Illinois are shown. One is a map of the counties to aid in the differentiation of streams with identical names (for example, one Vermilion River flows northwest to the Illinois River basin, another Vermilion River flows southeast to the Wabash River basin; both have headwaters in Ford County). The other map superimposes the major Illinois stream systems over the county outlines. (Woodard-USGS) W76-03913

WATER QUALITY IN RHODE RIVER AT SMITHSONIAN INSTITUTION PIER NEAR AN-NAPOLIS, MARYLAND, APRIL 1970 THROUGH DECEMBER 1973,

Geological Survey, Edgewater, Md. Chesapeake Bay Center. For primary bibliographic entry see Field 5A. W76-03914

### 8. ENGINEERING WORKS

#### 8A. Structures

NEW TOOL ACCELERATES DIRECTIONAL SURVEYING. For primary bibliographic entry see Field 7B.

ADEQUATE FORMATION TESTING CAN REDUCE COMPLETION COSTS, Halliburton Services, Duncan, Okla For primary bibliographic entry see Field 8G. W76-03759

JOHN DAY DAM, COLUMBIA RIVER, OREGON AND WASHINGTON; HYDRAULIC MODEL INVESTIGATIONS, Army Engineer Div. North Pacific, Bonneville, Oreg. Hydraulic Lab.

For primary bibliographic entry see Field 8B.

W76-03872

ICE HARBOR DAM, SNA WASHINGTON: HYDRAULIC SNAKE RIVER, MODEL IN-VESTIGATION

Army Engineer Div. North Pacific, Bonneville, Oreg. Hydraulic Lab. For primary bibliographic entry see Field 8B.

LOWER MONUMENTAL DAM, SNAKE RIVER, WASHINGTON: HYDRAULIC MODEL IN-VESTIGATION.

Army Engineer Div. North Pacific, Bonneville, Oreg. Hydraulic Lab.

For primary bibliographic entry see Field 8B. W76-03874

COWANESQUE LAKE, COWANESQUE RIVER, TIOGA COUNTY, PENNSYLVANIA, (FINAL ENVIRONMENTAL IMPACT STATEMENT). Corps of Engineers, Baltimore, Md.

Available from the National Technical Informa tion Service, Springfield, Va 22161 as EIS-PA-73-0345-F; ELR 0345; FLD/GP 13B. October 31, 1972, 128 p, 13 map, 10 photo, 13 tab.

Descriptors: \*Pennsylvania, \*Reservoir construc-tion, \*Recreation facilities, \*Flood control, Land-fills, Watershed, Basins, Flood plain insurance, Environmental effects, Marinas, Economics, Ter-restrial habitats, Aquatic habitats, Wildlife habitats

Identifiers: Cowanesque lake, Reservoir projects, Relocation of people, Recreational pool, Flood plain management.

A recommendation to allow construction of a reservoir project was given in this final environ-mental statement on the Cowanesque Lake. The reservoir project will involve the construction of an earth fill dam, dikes, service bridges, housing facilities, access roads, marina facilities, and recreational areas. An analysis was provided comparing the environmental setting without the project with the anticipated environmental setting with the project. Some of the adverse effects ex pected include the inundation of 410 acres of land by the recreational pool which will eliminate the habitat for all associated terrestrial biota and certain stream dwelling aquatic biota, the relocation of 600 persons, and occasional inundation of 3690 acres by the flood pool. Alternative proposals to the reservoir which were considered included watershed treatments, flood insurance, flood plain management, flood proofing, and a dam with dry lake. These adverse effects and alternative proposals were outweighed, however, by the flood control, recreational are development, and economic enhancements which the proposed plan is expected to produce. (Hoffman-Florida) W76-03923

NAVAL SUBMARINE BASE, NEW LONDON, GROTON, CONNECTICUT DREDGE RIVER CHANNEL, VOLUME 1, (ENVIRONMENTAL IMPACT STATEMENT).

Department of the Navy, Washington, D.C. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as EIS-CT-74-0077-F-1 (Jan 1974). 74-0077-F-1 (January 1974). 318 p, 41 fig, 17 tab, 2 append.

Descriptors: \*Environmental \*Connecticut, \*Dredging, \*Submarines, \*Channel \*Connecticut, Dreuging, Statement of Miliatry aspects, improvemen p Navigable rivers, Miliatry aspects, Miliatry Shins, Transportation, Military improvemen p Navigable rivers, Miliarry aspects, Underwater, Ships, Transportation, Military reservations, Federal government, Aesthetics, Spoil banks, Sounds, Water pollution sources, Water pollution, Water pollution effects, Benthos. Identifiers: \*Environmental Impact Statement, Hazardous substances(Pollution), Offshore spoil disposal.

The project involves deepening and widening a navigation channel from the U.S. Naval Submarine Base, New London, Connecticut, to Long Island Sound, and offshore dumping of dredged spoil. Presently, the area possesses no aesthetic or historic resources, and is affected by the presence of numerous piers and substantial shipping activi-ty. Adverse environmental effects such as increases in water turbidity, decreases in water quality, offensive gases, and destruction of faunal and epifaunal biota will occur during dredging and dumping operations. However, long-term effects to the marine ecosystem will be minimized. Alternatives considered were: (1) no project, (2) different utilization of the river area, and (3) alternate dredging and disposal methods. The proposed dredging is consistent with existing Naval Base operations, will accommodate larger submarines, and will increase navigability in the channel. In addition to the cost of construction and maintenance, irreversible commitments of resources involve removal of dredged spoil including all biological resources in the spoil, as well as disruption and pollution of the ecosystem at the dumpsite. Commentators were concerned about pollution caused by the dumping of dredged spoil. (Fernandez-W76-03924

GEOTHERMAL LEASING PROGRAM, VOLS. II AND III-LEASING OF GEOTHERMAL RESOURCES IN THREE CALIFORNIA AREAS (FINAL ENVIRONMENTAL IMPACT STATE-

Department of the Interior, Washington, D.C. For primary bibliographic entry see Field 4B. W76-03925

### 8B. Hydraulics

UNIQUE DESIGN IDEAS MAY INCREASE BIT

For primary bibliographic entry see Field 8C. W76-03523

NEW LOG DATA GIVE BETTER NORTH SEA

NEW LOG DATA GIVE BETTER NORTH WELL COMPLETIONS, Conoco North Sea, Inc., London (England). For primary bibliographic entry see Field 4B. W76-03524

FILTER-PACK INSTALLATION AND REDEVELOPMENT TECHNIQUES FOR SHAL-LOW RECHARGE SHAFTS, Agricultural Research Service, Fresno, Calif.

Water Management Research. For primary bibliographic entry see Field 4B. W76-03527

MEASURING WATER VELOCITY BY ULTRASONIC FLOWMETER,
Bureau of Reclamation, Denver, Colo. Hydraulics

J. C. Schuster. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 101, No HY12, Proceedings Paper 11806, p 1503-1517, December 1975. 11 fig, 4 tab, 4 ref, 1 append.

Descriptors: \*Ultrasonics, \*Closed conduit flow, \*Velocity, \*Venturi meters, \*Flow measurement, \*Electronic equipment, \*Open channel flow, Discharge measurement, Hydraulics, Pipelines, Calibrations, Testing, Laboratory tests.

Identifiers: Transducers, Test results, Integration, **Ouadrature methods**. Errors

A limited study of a sing-around ultrasonic flow-meter was made in a 2.5-ft square laboratory chan-nel. Traversing the flow vertically with the mete-transducers produced a satisfactory velocity profile. Integration of the profile by manual

methods showed a deviation of -3.4% compared to the bulk flow velocity Q/A measured by a venturi meter in a symmetrical profile for flows ranging from 3 cfs-11.4 cfs. Deviations of +14% to -6% were found in an unsymmetrical flow caused by a thin vertical plate having a width 10% of the channel width. General operation of the meter was satisfactory, and the sing-around principle ap-peared satisfactory for discharge measurement. (Lardner-ISWS) W76-03749

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eter city PERFORMANCE OF PENNSYLVANIA HIGHWAY DRAINAGE INLETS, Lehigh Univ., Bethlehem. Dept. of Civil Engineer-

ing.
A. W. Brune, W. H. Graf, E. Appel, and P. P. Yee.
Journal of the Hydraulics Division, American
Society of Civil Engineers, Vol 101, No HY12,
Proceedings Paper 11801, p 1519-1536, December
1975. 15 fig, 5 tab, 9 ref, 2 append.

Descriptors: \*Drainage, \*Intakes structures, \*Hydraulics, \*Hydraulic similitude, \*Pennsylvania, \*Highways, Paving, Runoff, Slopes, Grading, Discharge(Water), Testing, Performance, Efficiencies, Laboratory tests, Drains. Identifiers: Grating, Similarities.

The hydraulic performance of six gratings for the drainage inlets used by the Pennsylvania Department of Transportation were tested hydraulically using a scale ratio for the model: prototype of 1:2. Basic principles of similitude were applied to cor-relate model and prototype behavior. The variables in the tests were the discharge rate, and the three slopes of swale, side, and longitudinal or grade, in order to determine the hydraulic efficiencies at different rates of approach flow. The tests showed that the efficiency of a grating decreases with an increase in grade; the efficienty is a max-imum with both side slopes being equal. The geometrical configuration of the grating did not affect the efficiency of a grating. Ponding of a grating at the bottom of a vertical curve occurred only under extremely high rates of flow. Installing a dike downstream from an inlet in a median in-creased the capacity markedly. (Lardner-ISWS) W76-03750

STREAMLINING HEAD-LOSS CALCULA-

Gilbert Associates, Reading, Pa.

A. M. Larson, Jr. Chemical Engineering, Vol 82, No 23, p 115-118, October 27, 1975. 3 fig, 4 tab.

Descriptors: \*Pipes, \*Piping systems(Mechanical), \*Head loss, \*Pipeflow, Pipe lines, Reynolds number, Flow, Fluid mechanics, Flow rates, Temperature.

A procedure is presented that can simplify the determination of head-loss of flowing fluids over a range of pipe sizes and temperatures. The method combines calculation and graphical construction to simplify the evaluation of fvv/2g and vv/2g. The method requires a minimum of detailed calculamethod requires a minimum of detailed calcula-tions and is very useful for performing parametric head-loss studies in liquid systems consisting of two or more pipe sizes and having varying liquid temperatures in different branches. An example is used to illustrate the method with step-by-step in-structions. (Orr-FIRL) W76-03812

THE SIZE AND SHAPE OF SMALL-SCALE CURRENT RIPPLES: AN EXPERIMENTAL STUDY USING MEDIUM SAND, Keele Univ. (England). Dept. of Geology. For primary bibliographic entry see Field 2J. W76.0128. W76-03854

LOCAL EROSION CAUSED BY RAPID

FORCED INFILTRATION,
Aberdeen Univ. (Scotland). Dept. of Engineering.
For primary bibliographic entry see Field 2J. W76-03858

SEDIMENT MOVEMENT AND FRICTION IN

SEDIMENT MOVEMENT AND FRICTION AND ALLUVIAL STREAMS, Nigeria Univ., East Central State. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 2J. W76-03859

JOHN DAY DAM, COLUMBIA RIVER, OREGON AND WASHINGTON; HYDRAULIC MODEL INVESTIGATIONS, Army Engineer Div. North Pacific, Bonneville, Oreg. Hydraulic Lab. R. L. Johnson, and L. Z. Perkins. Available from the National Technical Information Service, Springfield, Va 22161 as ADJA-000 326. Price \$7.75 in paper copy, \$2.25 in microfiche. Technical Report No. 90-1, June 1972. 221 p, 169 fig, 15 tab, 2 ref. fig, 15 tab, 2 ref.

Descriptors: \*Model studies, \*Hydraulic struc-tures, \*Dams, \*Columbia River, Spillways, Powerplants, Hydroelectric plants, Diversion structures, Diversion dams, Cofferdams, Reser-voirs, Fish ladders, Reservoir operation, Flow, Flow measurement, Hydraulics, Hydraulic design, Structures, Civil engineering.
Identifiers: \*John Day Dam(Wash and Ore).

The John Day Project includes a 20-bay spillway, a 20-unit powerhouse (ultimate installation), a single-lift navigation lock 86 ft wide by 675 ft long with a maximum lift of 113 ft, and a 24-ft-wide fish ladder on each bank of the river. Average head on the structures is about 105 ft. Excavation require ments, diversion plans, structures locations, and methods of project operation were studied in a 1:80-scale model that reproduced 2.9 miles of river channel and pertinent overbank topography. A 1:25-scale model was used to determine maximum limits for completion of skeleton powerhouse units through which the river would be diverted during third-stage construction. Improved designs were developed for the first- and second-step cofferdams, navigation lock approaches, temporary and permanent fishway entrances, auxiliary water in-take for the Oregon shore fishway, powerhouse tailrace, skeleton units, and disposal fills. Limits for an interim cofferdam on the Oregon shore were evaluated; and satisfactory methods for operation of the completed spiilway and fishway entrances were determined. (Sims-ISWS)

ICE HARBOR DAM, SNAKE RIVER, WASHINGTON: HYDRAULIC MODEL IN-

VESTIGATION, Army Engineer Div. North Pacific, Bonneville, Oreg. Hydraulic Lab. L. Z. Perkins.

L. L. Perkins. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as AD/A-000 308. Price \$6.00 in paper copy, \$2.25 in microfiche. Technical Report No. 22-1, November 1973. 138 p, 99 fig, 11 tab, 3 ref, 1 append.

Descriptors: \*Model studies, \*Hydraulic models, \*Dams, \*Hydraulic structures, Spillways, Powerplants, Hydraelic stitutions, Spinways, Tower plants, Hydroelectric plants, Diversion structures, Diversion dams, Cofferdams, Fish ladders, Locks, Navigation, Flow, Flow measurement, Hydraulics, Hydraulic design, Structures, Civil engineering.

Identifiers: \*Ice Harbor Dam(Wash), \*Snake

Flow conditions to be expected during and after construction of Ice Harbor Dam were determined in a 1:100-scale hydraulic model that reproduced 2.7 miles of riverbed, pertinent overbank areas,

successive structures, excavated channels, and successive structures, excavated channels, and disposal sites. The purposes of the model study were to check the adequacy of originial designs for the project and to develop revisions if required to benefit fish passage, river navigation, energy dissipation, and power generation. Improved designs for the first- and second-stage cofferdams, fish-way entrances, powerhouse tailrace, and navigation lock outlet were developed in the model. Diversion of a major portion of the river discharge through three powerhouse skeleton units would facilitate the upstream passage of fish during second-step construction. Alternative methods for operation of the completed project were evaluated. (Sims-ISWS)

LOWER MONUMENTAL DAM, SNAKE RIVER, WASHINGTON: HYDRAULIC MODEL IN-VESTIGATION,

Army Engineer Div. North Pacific, Bonneville,

Oreg. Hydraulic Lab.
A. J. Chanda, and L. Z. Perkins.

A. J. Chanda, and L. Z. Perkins. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as AD/A-000 331. Price \$6.00 in paper copy, \$2.25 in microfiche. Technical Report No. 102-1, May 1974. 132 p, 98 fig, 8 tab, 4 ref.

Descriptors: \*Model studies, \*Hydraulic models, \*Dams, Structures, Hydarulic structures, Diver-sion structures, Dam design, Tailwater, Cofferdams, Fish passages, Hydraulic similitude, Hydraulics, Civil engineering.
Identifiers: \*Lower Monumental Dam(Wash).

Lower Monumental Dam is located 41.6 mi above the mouth of the Snake River and 35 mi northeast of Pasco, Washington, Maximum head on the pro-ject is 103 ft; the project design discharge is 850,000 cfs. Excavation requirements, diversion plans, structures locations, and methods of opera-tion were studied in a 1:100-scale model that reproduced 2.4 mi of river channel and pertinent overbank topography. The first-step cofferdam and diversion channel were designed to protect the work area against discharges to 250,000 cfs. The diversion channel and cofferdams cells were diversion channel and cofferdams cells were revised and the location of a temporary fishway was determined by means of the model study. Tests of the second-step cofferdam, designed for 200,000 cfs, indicated that the height of four upstream cells should be increased 3 ft, the three downstream cells could be lowered 6 ft, and a small cell should be added upstream from the north temporary fishway entrance. The fish trolley release point was satisfactory. Ice Harbor pool should be regulated to maintain acceptable conditions for fish passage during river flows between 40,000 and 80,000 cfs. Conditions with the structures installed were satisfactory after the tures installed were satisfactory after the pumphouse for auxiliary fish attraction flow was realigned and moved 22.5 ft downstream, a disposal fill on the north shore was eliminated, and an 80-ft-wide berm was excavated to elev 405 downstream for the stilling basin. (Sims-ISWS) W76-03874

### 8C. Hydraulic Machinery

UNIQUE DESIGN IDEAS MAY INCREASE BIT

World Oil, Gulf Publishing Company, p 67-69, September 1975. 5 fig.

Descriptors: \*Drilling equipment, Rotary drilling, Oil wells.

Identifiers: \*Drill bit, \*Spark drill, \*Terra drill, \*Continuous chain bit, Downhole changeable bit, Drilling rate.

Four unusual new drill bits are being developed by Sandia Laboratories, Albuquerque, New Mexico to speed drilling and downhole bit life. These new ideas in bit design include the spark drill, terra

### Field 8—ENGINEERING WORKS

### Group 8C-Hydraulic Machinery

drill, continuous chain bit, and downhole changeable bit. Spark drilling seems to have the greatest potential. It involves generation of high voltage sparks between electrode gaps located on the bottom surface of the bit. Sparks are generated around the circumference of the bit to spall or chip the rock as the bit makes contact with the bottom of the hole. The terra drill involves firing projectiles between the spacings of a standard tri-cone roller bit. The projectiles weaken the rock ahead of the bit which then pulverizes fractured segments and cuts the hole to the proper diameter. The continuous chain bit has a cutting surface located on the face of a continuous chain circulating between two sprockets at the bottom and at the top of the bit. As a segment of chain is worn out it is replaced by another segment of chain. The downhole changeable system would rotate a new set of roller cones into place at the bottom of the hole without having to pull the drillstem. (Gass-NWWA)

PULSE TRANSFER GIVES THICKER SLUDGE, Dorr-Oliver, Inc., Stamford, Conn. Environmental Applications. For primary bibliographic entry see Field 5D. W76.01365.

GET THE MOST FROM THE FINAL CLARIFIERS, Envirex Inc., Waukesha, Wis. For primary bibliographic entry see Field 5D. W76-03687

CONTROLLING WELL KICKS WHEN SHUT-IN METHODS ARE UNSAFE, Shell Oil Co., Houston, Tex. F. J. Fisher, and R. L. Kastor. World Oil, Vol 181, No 5, p 61-67, October 1975, 5 fig, 1 tab, 7 ref.

Descriptors: \*Computer models, Drilling, Wells, Computer programs, \*Pumping. Identifiers: Low choke pressure method, Well kick, Kicking well analysis, KIKSIM computer program, Mud pit level, Well shut-in.

Frequently a drilling well cannot be shut in on a kick without significant danger of causing a subsurface blowout, but control often may be retained by increasing the circulation rate to a predicatble, critical value. Pumping rate control is influenced by the time required to initiate the increased rate and whether or not kill mud is being introduced. Theoretical analysis indicates that in a well that cannot be shut in or killed using a constant bottom hole pressure well control method because of a limiting fracture pressure, a critical circulation rate may exist above which the well can be con-trolled without exceeding the critical annulus pressure. The circulation rate required may be so high as not to be feasible. The rate can be estimated by utilizing the computer model for any particular configuration. The primary advantage offered by computer analysis is being able to anticipate the courses of action that are open to the operator in the event a kick is encountered. Calculations can yield the estimated circulation rate that would be required to control the well. If the rate is unrealistic to the rig, then the well would have to be shut in to avoid an underground blowout. It also will establish the circumstances under which the well may be safely controlled by increasing the cir-culation rate to some obtainable level. (Ukayli-NWWA) W76-03760

TRUMMER TUBE SCREW PUMP. Effluent and Water Treatment Journal, Vol 15, No 9, p 491, September, 1975. 1 fig.

Descriptors: \*Pumps, \*Pumping, Hydraulic equipment, Water conveyance, Hydraulic machinery.

Identifiers: Screw pumps, Trummer tube screw pump.

The Trummer tube screw pump was introduced in 1969 by the Trummer Company of Switzerland. The tube screw pump extends the range and application of screw pumps, reduces overall costs, and increases efficiency. The pump consists of an inner and outer tube with the screw flights contained in the space between the two tubes; the assembly is welded together and flange mounted to a bearing at either end. The pumping action is caused by rotation of the complete tube assembly. Novel design features have permitted the following advantages: no exposed rotating flights; elimination of the concrete trough; less smell and no splashing; increased efficiency at low speeds; no jamming at inlet to pump; and, no wear or loss of efficiency at tip of flights. A complete range of pumps is available with capacities up to 4000 liters/s and lifts up to 16 m at inclinations of 30 to 40 degrees. (Orr-FIRL)

PUMPS: APPLICATION AND DESIGN BASICS, PART II, Clarkson Coll. of Technology, Potsdam, N. Y.

Clarkson Coll. of Technology, Potsdam, N. Y. Dept. of Chemical Engineering.
N. P. Chermisinoff.
Water and Sewage Works, Vol 122, No 10, p 66-67, October, 1975. 1 fig, 2 tab.

Descriptors: \*Pumps, \*Pumping, Hydraulics, Hydraulic engineering, Equipment, Hydraulic equipment, Hydraulic machinery, Water conveyance, Design criteria.

Reciprocating pumps are positive-displacement pumps in which the piston movement discharges a specific volume of liquid during each stroke. Direct acting pumps can be simplex units comprising one steam and one liquid piston, or duplex units comprising two steam and two liquid pistons. They have a pulsating discharge. Power pumps involve a crankshaft that is driven from an external electric motor with gears usually located between the drive and crankshaft. Diaphragm pumps are used for large flows of clean or solid-containing fluids. Rotary plunger pumps are single-acting pumps with five to seven plungers positioned in a circle. The following terms are defined to aid in the understanding of various pump design parameters: head, static head, static suction head, static discharge head, total static head, friction head, suction head, discharge head, total head, net positive suction head, discharge head, total head, net positive suction head, static suction lift, suction li

### 8D. Soil Mechanics

ANALYSIS OF THE PORE PRESSURE CHANGES FOLLOWING THE EXCAVATION OF A SLOPE, Hardy (R. M.) and Associates Ltd, Edmonton

(Alberta). K. D. Eigenbrod.

Canadian Geotechnical Journal, Vol 12, No 3, p 429-440, August 1975. 9 fig, 22 ref, 1 append.

Descriptors: \*Pore pressure, \*Slopes, \*Excavation, Equilibrium Negative pore pressure, Effective stress, On-site investigations, Stress analysis, Finite element analysis, Soil physical properties, Strain, Loads(Forces), Groundwater, Stability, Model studies, Landslide, Elastic deformation, Consolidation. Identifiers: Unloading, Dissipation, Swelling.

In a numerical analysis, the pore pressure changes and the subsequent dissipation of excess pore pressures due to excavation of a slope were calculated. The analytical results of the pore pressure changes due to to unloading of a slope agreed reasonably well with pore pressure measurements in comparable embankments. This suggested that pore pressures immediately after slope excavation can be predicted analytically in homogeneous materials. The results of an analysis dealing with the dissipation of excess pore pressures due to unloading can also be substantiated by field evidence; however, only few comparable field data are available. For many slopes it can be noted that the time for full dissipation is of the same order of magnitude as the time between excavation and failure. This suggests that many failures might be caused by the delayed equalization of pore pressures. (Visocky-ISWS)

### 8G. Materials

NEW LOG DATA GIVE BETTER NORTH SEA WELL COMPLETIONS, Conoco North Sea, Inc., London (England). For primary bibliographic entry see Field 4B. W76-03524

IRON BACTERIA AND RED WATER, Dearborn Chemical Div., Mich. For primary bibliographic entry see Field 5B. W76-03640

MEASURING WATER VELOCITY BY ULTRASONIC FLOWMETER,
Bureau of Reclamation, Denver, Colo. Hydraulics Branch.
For primary bibliographic entry see Field 8B.
W76-03749

ADEQUATE FORMATION TESTING CAN REDUCE COMPLETION COSTS, Halliburton Services, Duncan, Okla. A. G. Edwards.

A. G. Edwards. World Oil, Vol 181, No 5, p 83-91, October 1975. 5 fig, 7 ref.

Descriptors: \*Operating costs, \*Testing, \*Testing procedures, Reservoir storage.

Identifiers: APR tester, OD BT pressure recorder, OD RT-7 temperature recorder, Hookwall test string, Sour reservoir, Sour gas, \*Drill pipes, \*Drill rigs.

Several methods are available for testing from floating or bottom supported drilling rigs. New high pressure sampling equipment permits detection of hydrogen sulfide or carbon dioxide in a reservoir prior to completing the well. Other systems may be used to perform extensive production tests. Such systems are being used offshore on both platforms and floating vessels to determine reservoir limits and capabilities. Three systems being used for testing offshore reservoirs that contain H2S are described. These systems offer the operator a wide choice of equipment that can be tailored to the well conditions and type of reservoir analysis desired. Substantial savings in completion costs may occur in areas where sour production was anticipated, but was not present. In this case, a well test prior to completion would indicate to the operator that high cost, special corrosion resistant materials were not required. (Ukayli-NWWA)

CONTROLLING WELL KICKS WHEN SHUT-IN METHODS ARE UNSAFE, Shell Oil Co., Houston, Tex. For primary bibliographic entry see Field 8C. W76-03760

PVC PIPE IN WATER DISTRIBUTION: RELIA-BILITY AND DURABILITY, Petrochemicals Co., Inc., Fort Worth, Tex. For primary bibliographic entry see Field 5F. W76-03830

### 8H. Rapid Excavation

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DRESSING SPUDDER BITS. Water Well Journal, Vol 29, No 12, p 24-25, December 1975.

Descriptors: Thermal expansion, Thermal properties, Drilling equipment, Drilling, Water wells, Fluid mechanics.

Heattiffier: \*Saudder bits Tempering Drilling

Identifiers: \*Spudder bits, Tempering, Drilling

A system is proposed for 'dressing' or reworking used 'spudder' or percussion water well drilling bits. The bit is placed in a coal forge and rotated until the cutting end reaches a bright cherry red color. The bit is then placed in the anvil block for spreading with sledge hammers. The spreading should always start at the center of the bit and pull the sludge, as the flow is struck, in the direction the metal is to be worked. As soon as the angle of penetration is established, the bit is further dressed to establish the shape of the wearing surface, the reaming edges, the points and to bring the bit into gage. After the bit has cooled, it is ready tempering. The bit is immersed end up in clean water. It is quickly removed and a streak should be filed along the side of the bit down to the point. Under incandescent light, the streak will exhibit various colors. The color should be allowed to travel down the bit until the dark blue has reached the upper corners and the straw color has reached the cutting surfaces. Then re-immerse the bit to lock in the temper. After several sharpenings, the water courses tend to fill with metal. One method for removing this is using a U-shaped gouge driven back along the water course while the bit is hot. (Fuller-NWWA)

### 8I. Fisheries Engineering

CONTRIBUTION OF NORTHERN PIKE FINGERLINGS RAISED IN A MANAGED MARSH TO THE PIKE POPULATION OF AN ADJACENT LAKE,

Michigan Dept. of Natural Resources, Hastings. G. B. Beyerle, and J. E. Williams. Prog Fish-Cult, Vol 35, No 2, p 99-103, 1973.

Descriptors: \*Pikes, \*Fry, Mortality, Fish stocking, \*Michigan.
Identifiers: \*Long Lake(Mich).

An average of 4827 fingerling pike/yr were marked and stocked in Long Lake (Michigan, USA) for 3 consecutive years. An estimated average of 1339 of these pike/year survived to fall of their 1st year. Together with an estimated yearly recruitment of 821 young-of-the-year pike from natural reproduction, an average of 2160 young-of-the-year pike existed in Long Lake each fall. Assuming an annual 50% natural mortality beyond the 1st year and a 25% angling harvest of pike 508 millimeters (20 inches) and over in length, it can be calculated that during the lifespan of 1 yr class of marked pike, 166 fish (3.4% of the fingerlings stocked) will be harvested by anglers. During the same period 84 of the unmarked pike will be harvested, making a total contribution to the fishery of 250 pike of each year class, and a total yearly harvest of 250 pike. After 3 yr of growth, marked pike in Long Lake averaged 3.5 in longer than the State average, and unmarked pike were 2.1 in longer. This rapid growth plus the calculated yearly harvest of less than 1 pike/acre would seem to indicate that the stocking rate of fingerling pike in Long Lake could be increased substantially with great benefit to the fishery.—Copyright 1973, Biological Abstracts, Inc. W76-03520

EXPERIMENTALLY INCREASED FISH STOCK—IN THE POND TYPE LAKE WARNIAK. IX. NUMBERS AND BIOMASS OF BOTTOM FAUNA, Polish Academy of Sciences, Warsaw. Inst. of Ecology. For primary bibliographic entry see Field 02H. W76-03539

WASTEWATER UTILIZATION IN IN-TEGRATED AQUACULTURE AND AGRICUL-TURE SYSTEMS, Agricultural Research Organization, Dor (Israel). Fish and Aquaculture Station. For primary bibliographic entry see Field 05D. W76-03543

POLYCULTURAL WASTEWATER RECLAMA-TION AT CALIFORNIA POLYTECHNIC STATE UNIVERSITY--AN ACADEMIC INSTRUC-TIONAL SYSTEM, California Polytechnic State Univ., San Luis Obispo. Dept. of Biological Sciences. For primary bibliographic entry see Field 05D. W76-03567

MINERAL QUALITY OF FISH POND EF-FLUENT RELATED TO SOIL PROPERTIES AND CROP PRODUCTION, Arkansas Univ., Fayetteville. For primary bibliographic entry see Field 03C. W76-03569

THE DIALECTICS OF A PROPOSAL ON BIOLOGICAL CONTROL OF EUTROPHICATION IN SEWAGE LAGOONS, National Taiwan Univ., Taipei. For primary bibliographic entry see Field 05C. W76-03570

CRITICAL VARIABLES IN FOOD-ITEM POPULATION DYNAMICS IN A WASTE-WATER AQUACULTURE SYSTEM,
Virginia Polytechnic Inst. and State Univ.,
Blacksburg.
For primary bibliographic entry see Field 03C.
W76-03572

THE FEASIBILITY OF PENAEID SHRIMP CUL-TURE IN BRACKISH PONDS RECEIVING TREATED SEWAGE EFFLUENT, North Carolina State Univ., Raleigh. For primary bibliographic entry see Field 05C. W76-03573

PRINCIPLES OF SEWAGE TREATMENT THROUGH UTILIZATION IN FISH PONDS, National Agricultural Quality Control Inst., Budapest (Hungary). For primary bibliographic entry see Field 05D. W76-03576

POTENTIAL EFFECTS OF AQUACULTURE ON INSHORE COASTAL WATERS, Virginia Univ., Charlottesville. Dept. of Environmental Sciences. For primary bibliographic entry see Field 05C. W76-03585

THE EMERGENCY MARINE FISHERIES PROTECTION ACT OF 1974, S 1988, North Carolina Univ. at Chapel Hill. For primary bibliographic entry see Field 06E. W76-03623

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W76-03524	4B	W76-03602	5G	W76-03680	5D	W76-03758	7B
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W76-03527	4B	W76-03605	6B	W76-03683	5D	W76-03761	5B
W76-03528	5A	W76-03606	6E	W76-03684	5D	W76-03762	6B
W76-03529	5A	W76-03607	6E	W76-03685	5D	W76-03763	5C
W76-03530	5A	W76-03608	6E	W76-03686	5D	W76-03764	5B
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W76-03532	5D	W76-03610	6E	W76-03688	5F	W76-03766	5C
W76-03533	5D	W76-03611	6E	W76-03689	5F	W76-03767	5C
W76-03534	5D	W76-03612	6E	W76-03690	5E	W76-03768	5C
W76-03535	6C	W76-03613	6E	W76-03691	5D	W76-03769	5C
W76-03536	5C	W76-03614	6E	W76-03692	5D	W76-03770	5C
W76-03537	5C	W76-03615	6E	W76-03693	5A	W76-03771	5C
	5C	W76-03616		W76-03694	5A	W76-03771	5C
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W76-03577	5C	W76-03656	5A	W76-03734	2L	W76-03812	
W76-03578	3E	W /0-03030	Jat.	11 10-03/34			

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W76-03816	5D		W76-03895	2L
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W76-03818 W76-03819	5G		W76-03897	21
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# ABSTRACT SOURCES

sou	IRCE	ACCESSION NUMBER	TOTAL
Α.	CENTERS OF COMPETENCE		
	East Central Oklahoma State University, Agricultural Livestock Wastes	W76-0396803971 0397303991	23
	Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W76-0366003661 0366503696 0369803708 0371003720 0378803795 0379703803 0380503812 0381403850 0399204000	125
	Illinois State Water Survey, Hydrology	W76-0372103756 0385103895	81
	Institute of Paper Chemistry, Water Pollution from Pulp and Paper Industry	W76-0354103560 0356203581	40
	National Water Well Association, Water Well Construction Technology	W76-0352203527 0375703762	12
	University of Florida, Eastern U. S. Water Law	W76-0358403626 0391603921 0392303958	85
	University of North Carolina, Metropolitan Water Resources Planning and Management	W76-03501 0362703630	5
	University of Wisconsin, Eutrophication	W76-0353703540	4
	University of Wisconsin, Water Resources Economics	W76-03535	1
В.	STATE WATER RESOURCES	W76-0395903963	5

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SOU	RCE HERENGALE RESERVA	ACCESSION NUMBER	TOTAL
c.	OTHER		
	BioSciences Information Service	W76-0352003521 03536, 03561 03637, 03639 0364803650 0366203664 03697, 03709 03796, 03804 03813, 03922 03964, 03972	20
	Effects of Pollutants on Aquatic Life (Katz)	W76-0364303647 0365103659 0376303787	39
	Environmental Protection Agency	W76-03528 0363103636	Telephone 7
	Forest Service (USDA)	W76-0396503967	109 191 3
	Ocean Engineering Information Service (Patents)	W76-0350203519	13
	U. S. Geological Survey	W76-0389603915	20
	Vanderbilt University, Metals Pollution	W76-0358203583 03638 0364003642	GUITER IN 6

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